

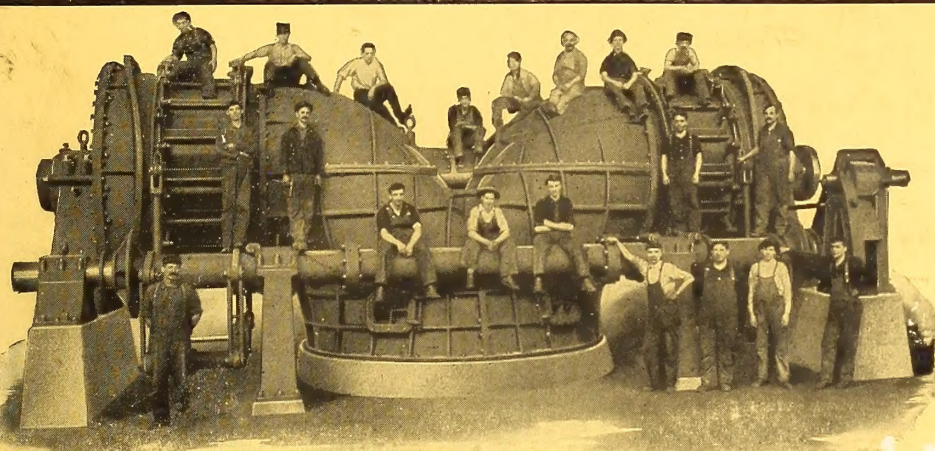
Southam

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Electrical News

Generation, Transmission and Application of Electricity



One of Three Units of Hydraulic Turbines

Furnished
Canadian Light & Power Co.
MONTREAL, P. Q.
Each 7200 H.P., 150 R.P.M.,
48 ft. Head

These were undoubtedly the
heaviest pair of Turbines
ever built.

Correspondence Solicited
S. Morgan Smith Co.
York, Pa.

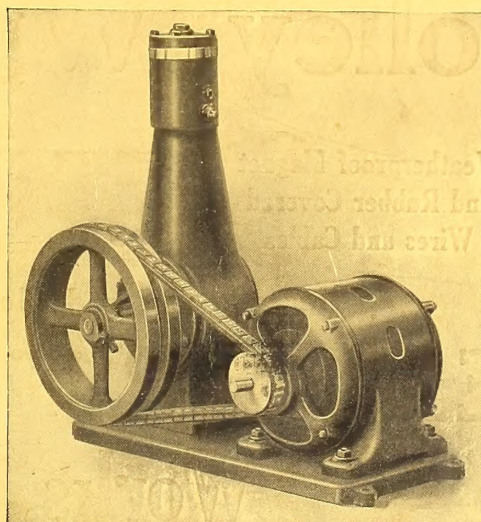
Branch Offices:
167 Federal St., BOSTON, MASS.
American Trust Bldg., CHICAGO.

Direct Connected Motor Driven Air Compressors

STANDARD BLAISDELL QUALITY

Automatic Lubrication
Enclosed Dust-Proof Frame
Water Jacketed
Air Pressure up to 250 lbs.
Speed 250-400 R. P. M.
Weight 365 lbs.

The Ideal Machine for Gar-
age use, Spraying, Air Brush,
Operating Pneumatic Tools,
Cleaning Machinery of all
kinds, Gas Engine Starting,
and for hundreds of other
purposes.



Removable and Renewable
Bearings
Shaft and Pins Turned True
and Ground
Direct Connected to 1 H. P.
Electric Motor for 100
lbs. Air Pressure
Fully Guaranteed

Also furnished in Belt and
Gear Drives.

Larger Sizes if desired, any
capacity to 5,000 cu. ft. per
minute.

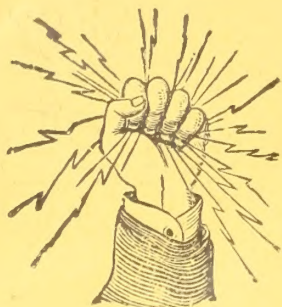
Prices by return mail if you
are interested.

Canada Foundry Company, Limited

TORONTO, ONTARIO

Montreal Halifax Ottawa Cobalt Winnipeg Calgary Vancouver Nelson Prince Rupert

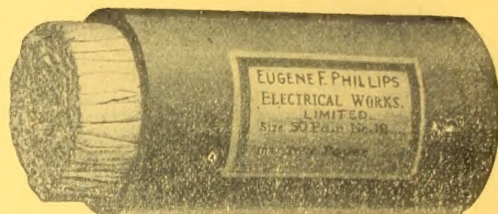
PHILLIPS



Bare and Insulated Copper

WIRES AND CABLES

For Telephone, Telegraph, Lighting,
Power and Street Railway Equipment



Bare and Insulated Electric Wire and
Cables for Aerial and Underground use

Railway, Feeder and Trolley Wire



Weatherproof Magnet
and Rubber Covered
Wires and Cables



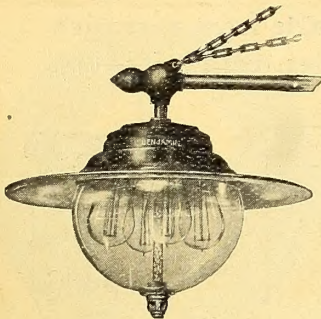
Incandescent and Flexible Cords

Eugene F. Phillips Electrical Works, Limited

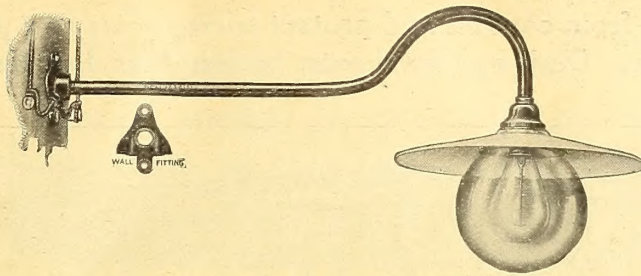
MONTREAL

CANADA

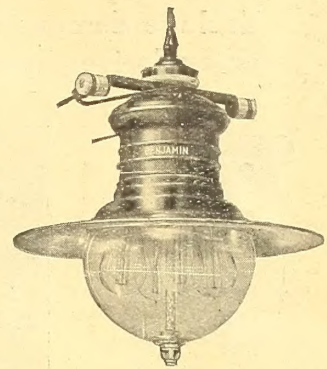
Branches: Halifax, Toronto, Winnipeg, Vancouver

MULTIPLE**BENJAMIN FIXTURES****MULTIPLE****Cat. No. T714**

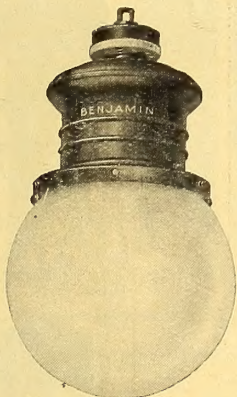
3' Mast Arm
T714—4 light
T715—5 light
Takes 100 watt lamps.

**Cat. No. T250**

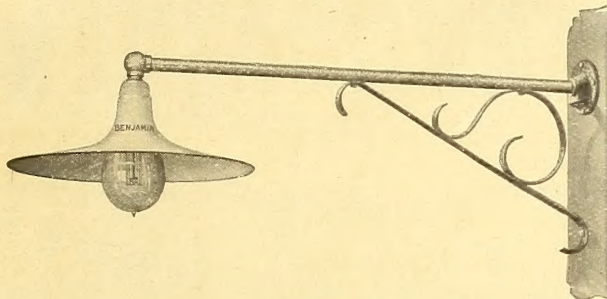
T100 Complete with 8" x 5" Globe, Gooseneck (30"), and Fitting
T250 " " 10" x 6" Globe, Gooseneck (30"), and Fitting
T101 " " 8" x 5" Globe, less Gooseneck and Fitting
T251 " " 10" x 6" Globe, less Gooseneck and Fitting

**Cat. No. T74**

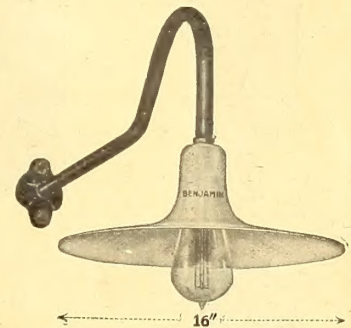
T74—4 light
T75—5 light
Takes 100 watt lamps

**Cat. No. 969**

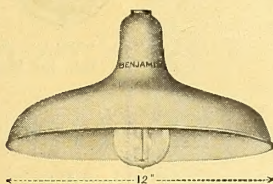
For 500 watt large base or 250 watt small base.
12" x 9" C.R.I. Ball.

**Cat. No. 995**

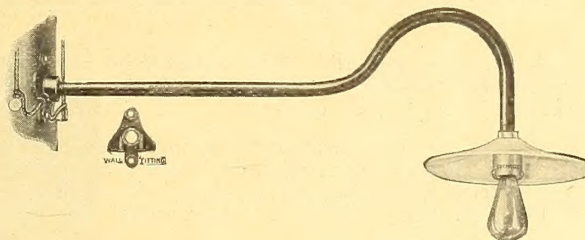
995 Complete with 14" Reflector, for 25-40 Watt Lamps
996 " " 16" " " 60-100 " "
997 " " 18" " " 150-250 " "
998 " " 20" " " 250-400 " "
999 " " 22" " " 400-500 " "

**Cat. No. 5412**

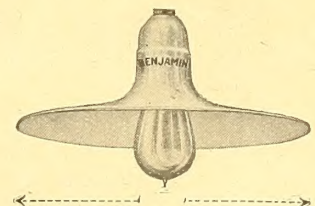
Other sizes from 14" to 22".
For Large or small base lamps.

**Cat. No. 5421**

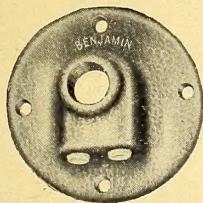
Bowl Reflector Socket

**Cat. No. 5101**

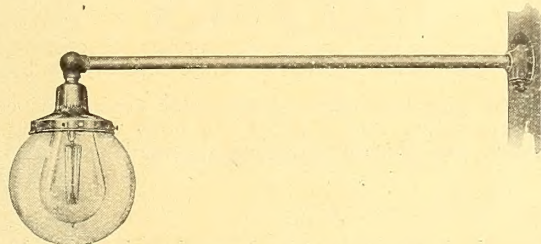
4101 10" Enameled Steel Refl., less Gooseneck and Fitting
4151 15" " " " " "
5101 Complete with 10" Enameled Steel Refl., Gooseneck (30")
5151 15" " " " " "
5161 " " 6" C. R. I. Globe, Gooseneck (30")

**Cat. No. 5402**

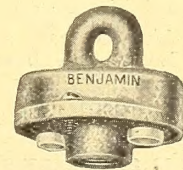
Flat Reflector Socket

**Cat. No. 5031**

Tapped 3/4"
Porcelain Bushings

**Cat. No. 990**

990 Complete with 10" x 6" Globe
991 " " 12" x 9" " "
992 " " 10" x 6" " " less Mast Arm and Fitting
993 " " 12" x 9" " " " "

**Cat. No. 6031**

Tapped 1/2"
Porcelain Bushings

FOR OTHER FIXTURES AND PRICES, SEE CATALOG C-20

Benjamin Electric Manufacturing Company
64 YORK STREET, TORONTO

Vapor-Proof Condulets—"V" and "VH" Series

Exclude dampness from conduit and protect current-carrying parts from corrosive or explosive vapors. Designed for boats, bath houses, breweries, refineries, etc.



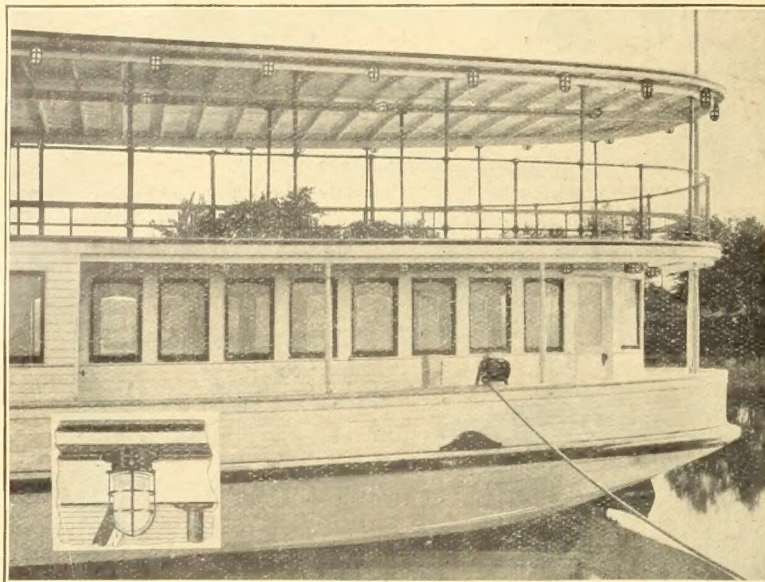
Type "VH"—One Side Hub, for Dead End.



Type "VHC"—Two Side Hubs, for Through Feed.



Type "VHL"—Two Side Hubs, for Right Angle Turn.



Showing "V" Series Condulets Installed on Boat

Condulets of the "V" and "VH" series take any of the several standard receptacles, and are made in six types, each in sizes to fit $\frac{1}{2}$, $\frac{3}{4}$ and 1-inch conduit.

"V" series Condulets accommodate incandescent lamps not exceeding $2\frac{3}{4}$ inches in diameter and 6 inches in over-all length, while "VH" series Condulets, being larger will mount lamps $3\frac{3}{4}$ inches in diameter and 8 inches in total length.

A complete Condulet of either series consists of a cast iron body, including threaded hub or hubs; a rubber gasket; a heavy glass globe, and a strong, riveted and welded guard.

Metal parts are furnished with either black enamel or galvanized finish to suit purchaser, and, while clear glass globes are regularly supplied, the choice of ruby, green, orange, blue or opal glass also is offered.

The globe is shaped to take threading on inner surface of casting, and screws firmly against rubber gasket, which, in turn, compasses against a flange midway to bottom of casting.

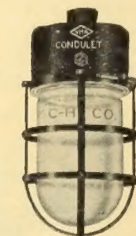
After globe is adjusted, the guard is clamped on outer surface of casting by means of a combination cam and lever, the cam fitting into a groove in body of Condulet. Eyelets are provided in lamp and base ring of guard for accommodation of small padlock, which prevents stealing of lamp.



Type "VHT"—Three Side Hubs, for Through Feed and Right Angle Branch



Type "VHX"—Four Side Hubs, for Through Feed and Two Right Angle Branches.



Type "VHA"—One Top Hub, for Dead End.

These and many other types described, illustrated and listed in Bulletin No. 100. Mailed free on request

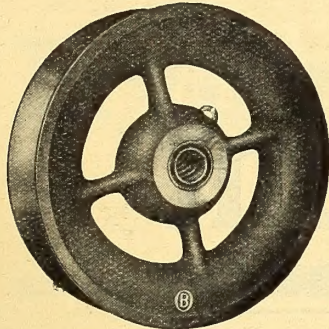
Crouse - Hinds Company of Canada, Limited



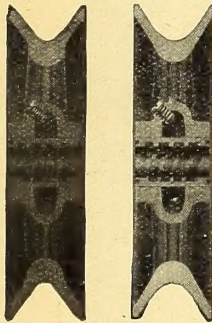
MAIN OFFICE AND WORKS
TORONTO, ONT., CAN.



O-B Trolley Wheels and Harps



O-B Trolley Wheel



V Groove U Groove

O-B Wheels are designed with ample thickness of metal in groove and an extra large oil reservoir in the hub.

The metal is exceedingly tough, without being hard and ensures a maximum length of service and minimum wear on the wire.

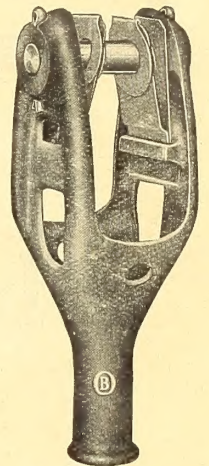
As our metal mixtures are continually checked by our chemical laboratory, you can be sure of receiving an absolutely uniform wheel every time you order. Made in "U" and "V" groove, 4, 5 and 6 inch sizes for $\frac{1}{2}$, $\frac{5}{8}$ and $\frac{3}{4}$ inch axle.

O-B Harps are made of malleable iron and the bronze contact springs and washers are simple, efficient and easily renewed.

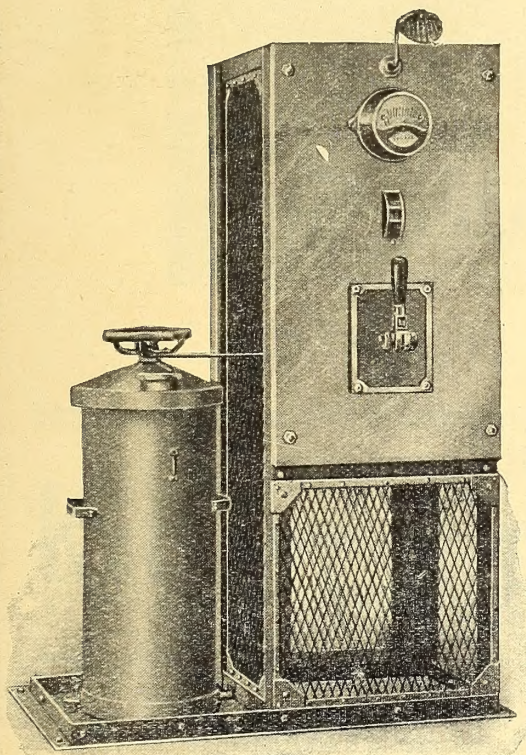
May we quote on your next requirements?

The Ohio Brass Company

Mansfield, Ohio



O-B Trolley Harp



High Tension Switch Panel and Oil
Immersed Starter
Interlocked

Manufacturers of
Control Gear
for

Electric Machinery

The man who installs correct control gear takes out
3 Insurance Policies.

- (1) In favor of the operator.
- (2) To safeguard the machinery controlled.
- (3) Against loss of profit by breakdown.

Union Electric Co. Ltd.
PARK ST., SOUTHWARK, LONDON S.E.

Announcement

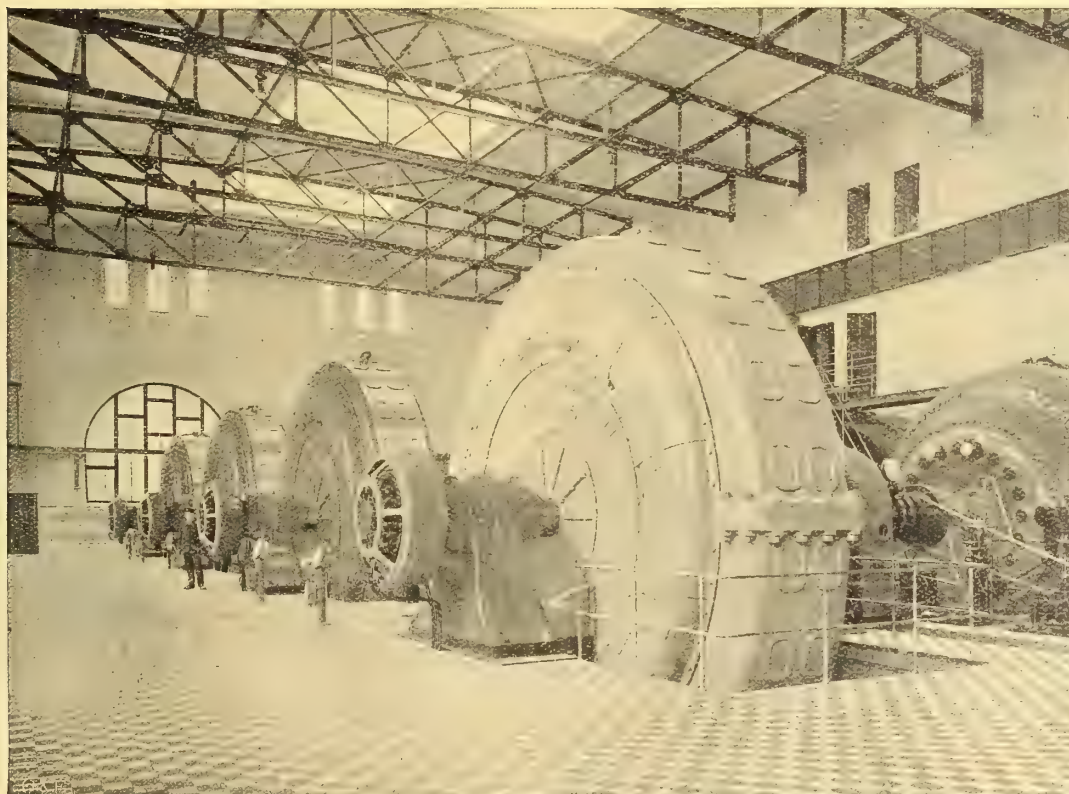
Imperial Wire & Cable Company Limited

beg to announce that they have acquired
the business and undertakings of

The Wire & Cable Co. Montreal

The new company will continue to
operate in Montreal without change in
management and solicits a continuance of
your patronage.

Swedish Government Hydro-Electric Plant at Trollhattan



Four of the Eight Horizontal, Totally Enclosed Water Wheel Driven Generators
11,000 K.V.A., 11,000 Volts, 3-Phase, 25 Cycles, 187.5 r.p.m.

Kilmer, Pullen & Burnham,

LIMITED

Head Office,
TORONTO



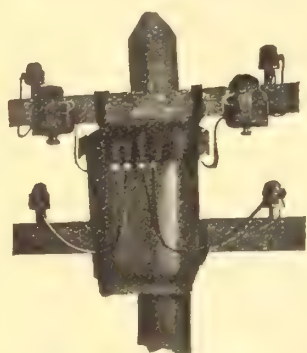
Branch Offices: MONTREAL
General Supplies Ltd.,
CALGARY, ALTA.

SOLE DEALERS FOR
The General Electric Co., of Sweden

MOLONEY

Transformers

On the Line



Moloney H. E. Transformer
in position on pole, and
methods of wiring.

For 14 years we have manufactured High Efficiency transformers—we make nothing else. Moloney Transformers convert current with the lowest possible core loss because they are designed and built by the largest independent manufacturers of transformers. A Moloney will give high efficiency every day and all day long.

In the Station



Type C. Oil-Cooled Transformer. Front view, showing wires and general appearance.

Before you buy or specify any transformer, get our data and performance. It will meet your requirements.

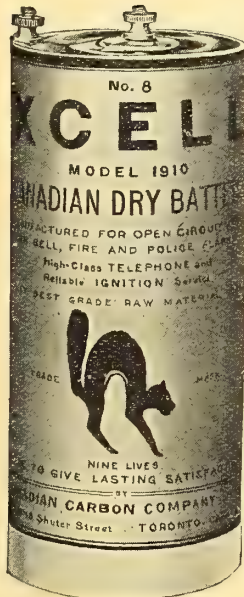
Canadian Moloney Electric Co.

Limited

Office and Works : WINDSOR, ONT.

District Agents: R. E. T. PRINGLE, Montreal, Que. HINTON ELECTRIC CO., Vancouver, B. C. CENTRAL and ELECTRIC SCHOOL SUPPLY CO., Toronto, Ont.

May Our Prosperity Be Yours



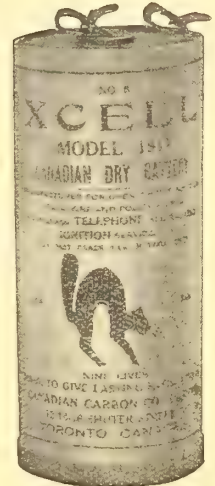
The manufacturing of our

X CELL BATTERIES

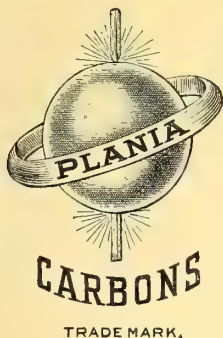
kept us exceedingly busy during the entire year. We consider it our most pleasant duty to thank our esteemed customers for the hearty support given us and we wish that EVERY-ONE of them shall feel just as

HAPPY

in the NEW YEAR as we are feeling now



CHEERFULNESS, PROSPERITY and NINE LIVES with you For Ever



Whatever we can do to help you to increase your PROFITS and to make your BATTERY and CARBON BUSINESS pleasant will be done. We have

TWO NEW YEAR GIFTS

for you. FIRST, the

New Improved X CELL

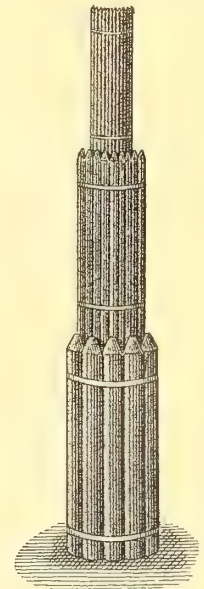
made under the latest process, just IT.

SECOND, we have added to our "NINE LIVE SPECIALTIES"

"PLANIA" CARBONS

Every Carbon sold by us has been gauged by hand. Perfect alignment without blisters and accurate diameter is fully GUARANTEED. If you want THE Carbons for ENCLOSED or PICTURE MACHINES, or FLAMING ARC, D. C. or A. C. white or yellow, write US.

REMEMBER, you can start a SAVINGS ACCOUNT in the NEW YEAR with the money you save in using our goods and will have a NICE BALANCE in 1913, having trusted our BLACK CAT during this year.



Canadian Carbon Co.
96 King St. West, TORONTO Limited



**Motors
Generators
Transformers**

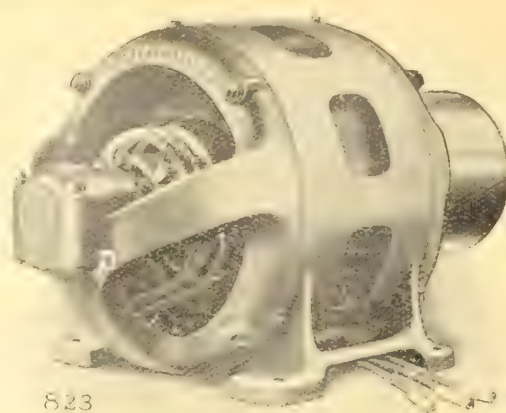
Induction

**Long Life Bearings
High Power Factor
Great Overload Capacity
Conservative Rating**

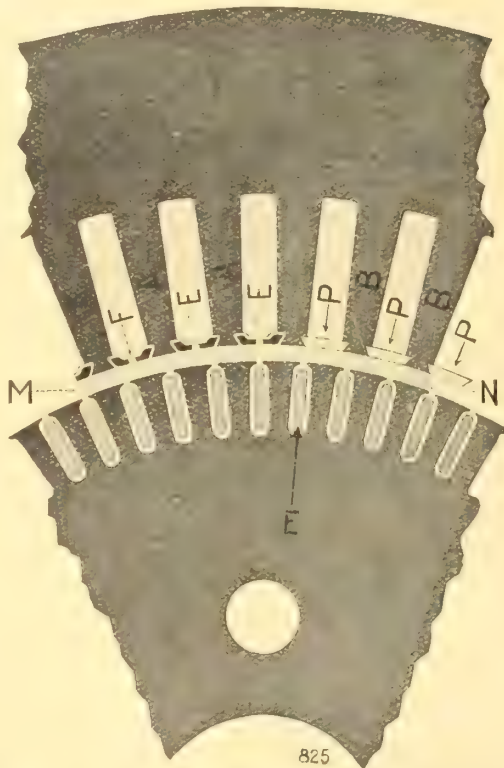
The manufacturers of induction motors may be divided into two schools:

Those who prefer the "open slot" construction and those who build under the "closed slot" principle. Each of these contends that their extreme is better than the other. The "open slot" advocates sacrifice electrical qualities to mechanical convenience. The "closed slot" adherents gain the highest electrical advantages, but have a motor which is very inconvenient mechanically.

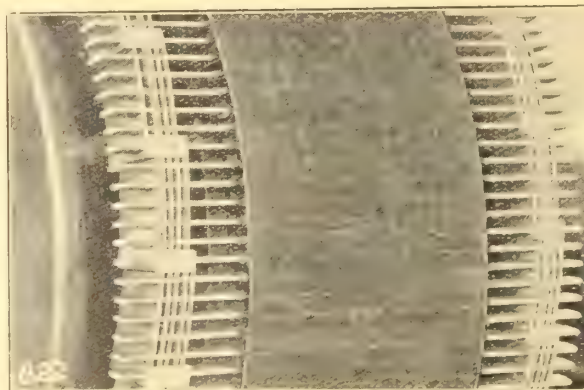
By means of the special arrangement of the end-rings shown in the illustration connections of uniform electrical resistance are provided, and all tendency toward local heating or concentration in one ring is avoided.



823



825



**Motors
Generators
Transformers**

Motors

**Extra Strong Starting Torque
Unusually Heavy Insulation
Convenience of Repairs
Efficient Ventilation**

In the C.-W. motor the slots are first made open, allowing plenty of space for the inserting of heavily-insulated form-wound coils, and are then closed by magnetic wedges which give all the electrical advantages of "closed slot" construction. The cut shows how the magnetic wedge "E" increases the distributing area of the tooth and allows the flux to travel a shorter path than is the case where the wood-wedge "P" is used.

For a further discussion of this subject and other interesting advantages of these motors write for induction motor booklet "E."

The C.-W. motor has more bars in the rotor than any other similar motor. This results in minimum flux leakage and high torque. This is why it takes a greater overload to stop a C.-W. Motor.

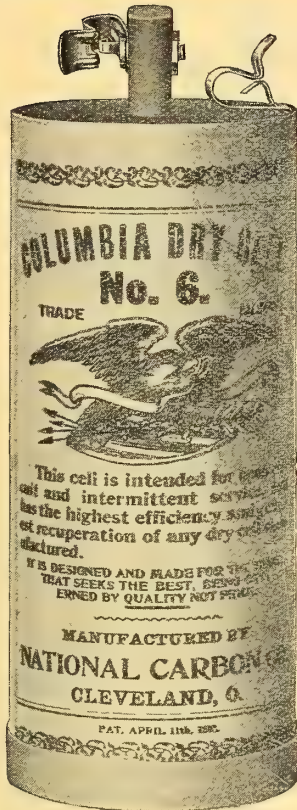
Canadian Crocker-Wheeler Co.

Manufacturers and Electrical Engineers

LIMITED

HEAD OFFICE AND WORKS : **ST. CATHARINES, ONT.**

BRANCH OFFICES : **MONTREAL, QUE.
VANCOUVER, B.C.**



Have you ever thought of this?

Every maker of dry cells claims the

Best Battery

Glance through the pages of this or any other magazine in which dry cell ads occur.

You will notice that every advertiser claims most for his particular brand.

Does it seem reasonable to you that all are best? Certainly not. How are you to judge? Here is a plan.

Study the history of the cells and the organization back of each. Make a test of those that seem best and you can then put your confidence in the one that wins out.

If you make a thorough investigation Columbia Dry Cell will win your order. It has been a leader for more than twenty years and still leads the list in international prestige, long life, reliability, economy, efficiency.

Our new factory at Toronto is growing already because of the confidence in Columbia batteries. We expect to enlarge it as rapidly as we can.

We will supply battery users with free samples for test if they are interested.

Address E-N-11

Canadian National Carbon Co., Ltd., 99 Paton Road, TORONTO, ONT.

Heating With Exhaust Steam

The Most Profitable Load An Engine Carries

Many of you are manufacturing heat in the form of steam, but what becomes of it? You are simply converting 10 to 14 per cent. of it into mechanical energy in the form of electricity, and throwing the balance away, either into the atmosphere or into the condenser.

The plant which operates non-condensing may have 10 per cent. heat efficiency and the condensing plant a possible 14 per cent. conversion.

Why Not Sell the Larger Amount of the Otherwise Lost Energy

You can get a price for it which will pay the total fuel bill of the plant, including also such other expenses as water, oil, etc.

CAN IT BE DONE? YES!

Others are not only doing that very thing, but are also earning interest and depreciation on the cost of the steam installation.

*We not only Make Reports and Build Central Station Plants,
but Solicit Business and Manage Such Plants, if Required.*

Why Not Take Advantage of Our Experience?

Central Station Heating & Construction Co.

714 Ellicott Square, BUFFALO, N. Y.

Canadian Office W. E. SKINNER LIMITED, Somerset Building, WINNIPEG

ELECTRIC FLOUR MILL

J.C. CAMERON IN
PRESIDENTCABLE ADDRESS: WHEATLEY
CODES USED: DIVERSITY, ROBINSONSHEDLEY SHAW
MANAGING DIRECTOR

HEAD OFFICE: BOARD OF TRADE BUILDING, TORONTO.

CAPACITY 12 000 BBL'S DAILY

ALL ACCEPTANCES SUBJECT TO OUR CONFIRMATION

Allis-Chalmers Co.,

Milwaukee, Wis.

Port Colborne, Nov. 3-11.

Gentlemen:

We hereby hand your representative, Mr. J. H. Hammill acceptance of our 4000 barrel flour mill which you have just completed. As you are aware this contract included in addition to the flour mill, the complete electrical equipment consisting of motors, transformers, switchboards, etc. which are manufactured at your Montreal Plant. In handing you this acceptance we are pleased to say all machinery and electrical equipment supplied under this contract is working satisfactorily.

The mill started without any trouble whatever, in fact we think our record of starting exceptional from the fact that in less than three hours after placing the wheat on the mill the flour was up to grade and ready for market. The mill is now running full time and capacity, and we have not found it necessary to make any changes whatever, every spout and cloth being correct.

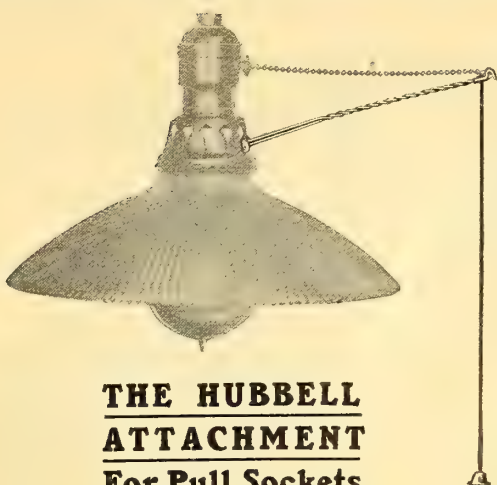
This is the second large complete flour mill you have built for us, having built our Kenora mill in 1909, and we are pleased to say that you have not only sustained your high standard of mill building as shown in our Kenora mill, but we consider you have surpassed your former efforts, in this case, and that our new Port Colborne mill stands unexcelled in point of equipment and efficiency in America.

Yours very truly,

JSB/B

Maple Leaf Milling Co. Limited.

Per *J. H. Hammill*
Mechanical Supt.



THE HUBBELL ATTACHMENT For Pull Sockets

This device makes the easiest working Pull Socket work easier. It reduces strain on the socket chain, takes all drag off the chain guide, increases the utility of the socket and lengthens the life of the lamp.

The arm is sufficiently long to allow the cord to hang beyond the edge of the shade.

A slight pull on the cord operates the socket without tilting the lamp or causing harmful vibration.

The Hubbell Attachment is protected by the following patents:

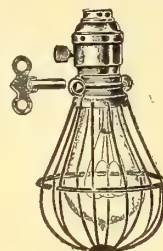
No. 904,476, Nov. 11th, 1908
No. 979,693, Dec. 27th, 1910
No. 989,845, Apr. 18th, 1911
No. 956,354, Apr. 26th, 1910

Dealers and Contractors wishing quotations and samples should address

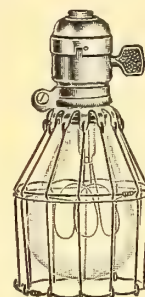
R. E. T. PRINGLE, Manufacturers' Agent
Montreal Windsor Toronto

McGILL LAMP GUARDS

AND PORTABLES



LOXON



STYLE "D"

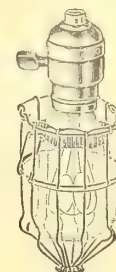
Cut down lamp bills by protecting lamps from

Theft and Breakage

also prevent fire from hot or broken lamps.

The four guards shown are all leaders in service as well as in sales. They represent just a part of the complete McGill line of Protector and Portable Lamp Guards and Electrical Specialties.

Send for catalog of line.



STYLE "H"



NATIONAL

Carried by all Canadian Electrical Dealers.

McGILL MFG. CO.
5 OAK ST., VALPARISO, IND.



Largest Exclusive Electrical Supply House in Western Canada



We Cover NORTHERN ONTARIO, MANITOBA, SASKATCHEWAN and ALBERTA.
Advise us by post card and we will have our traveller personally call on you.
All lines of standard electrical material carried in Winnipeg stock. PROMPT SHIPMENTS,
STANDARD PRICES, COURTEOUS TREATMENT. If you are NOT a customer, you
SHOULD be. It will pay you as well as ourselves.

Write for our new 1912 calendar.

The James Stuart Electric Co.
324 Smith St., Winnipeg, Man. Limited

WATTMETERS



D. C. Bergmann Wattmeter

During the past month, we have closed contracts for over 1,500 wattmeters, the larger portion for use on Hydro Electric Commission Lines.

Our prices, like our meters, are right.

We will gladly send sample meter to any recognized company for approval.



A. C. Bergmann Wattmeter

Chapman & Walker, Limited

Head Office : 69 Victoria Street, TORONTO, ONT.

Vancouver

Calgary

Montreal

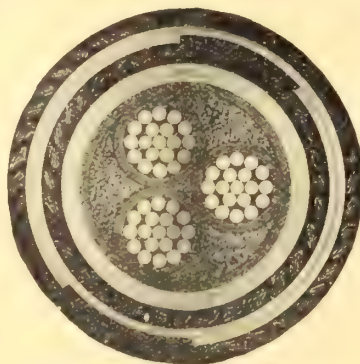
Winnipeg

V. I. R. Cables

Wire, Flexible

Paper Insulated
Lead Covered
Cables

Telephone Cables



.075 sq. in. three core, circular
lead covered, steel tape
armoured cable

Vulcanized Bitumen Cables

Transmission
Lines

Trailing Cables

MONTREAL AGENTS:

Alexander Macpherson & Son,
Montreal, Que.

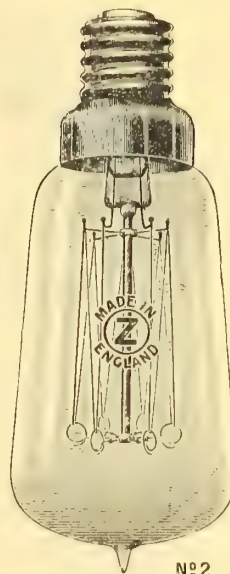
TORONTO AGENTS:

Chapman & Walker, Limited
69 Victoria Street
Toronto, Ont.

W. T. Henley's Telegraph Works Co. Limited

Contracts taken for complete Cable Systems installed

"Z" LAMPS



One of the greatest troubles with Tungsten Filament Lamps, a black deposit on the glass, has been successfully overcome in "**Z**" **Tungstens** by coating the stem of the lamps with **Phospham** which chemically absorbs the black deposit given off by the filament, thus keeping the bulb as clear as a new lamp. All "**Z**" lamps are fitted with **Standard Vitrite Insulate Bases**.

We have always in stock or on transit over 100,000 Carbon and Tungsten Lamps, which insures prompt delivery the same day as order is received.

Chapman & Walker

ENGINEERS AND CONTRACTORS

Head Office: 69 Victoria Street, Toronto, Ont.

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CALGARY
General Supplies, Ltd.
1233 Second St., E.

PORCUPINE
J. P. Bartleman

Stock Carried in Montreal, Toronto, Winnipeg, Calgary and Vancouver

Canada's Greatest Electrical Installations

in which our Conduit is used as an Armored Raceway for Electrical Wires



LUMSDEN BUILDING, TORONTO—"A GALVADUCT" BUILDING

During 1912 we propose to show in our advertisements a series of buildings, grain elevators, ships, factories and other structures in which

"Galvaduct" and "Loricated" Conduits

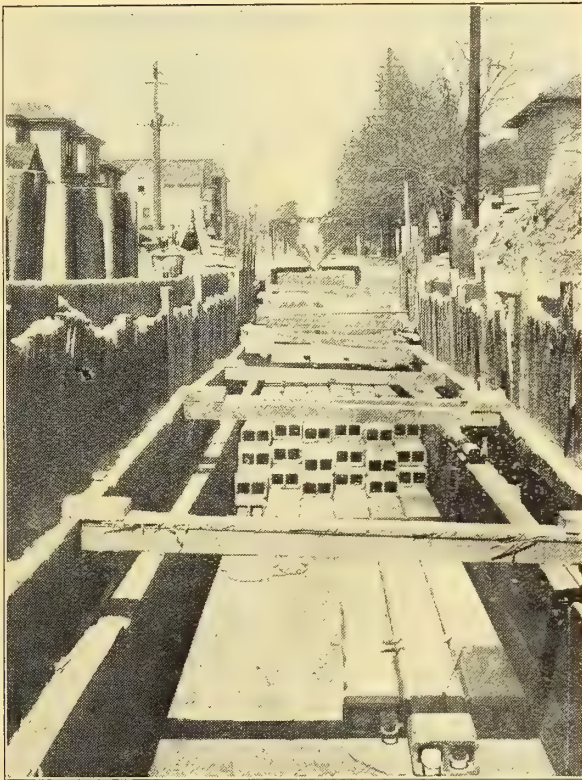
have been used for electrical installations. Conduit protection is a recognized necessity in modern building and engineering work.

The longest life under service conditions is assured by the use of the Conduits manufactured by

CONDUITS COMPANY LIMITED, Toronto and Montreal

G. M. GEST

Engineer
and Contractor

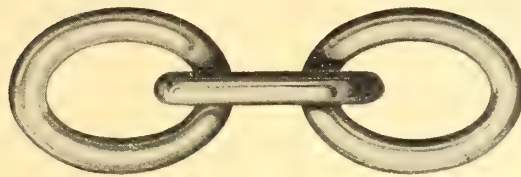


Electrical Underground Conduit Systems

When **G. M. GEST** designs and constructs your Conduit and Cable System you receive the benefit of many years' experience and specializing in that line of work.

Ask Our Customers

Power Building, Montreal, P.Q.



CHANDELIER CHAINS BRASS and STEEL

Largest Assortment in Canada. 150 Select Designs.

Write for 1912 Art Calendar and Catalogue.

W. H. BANFIELD & SONS

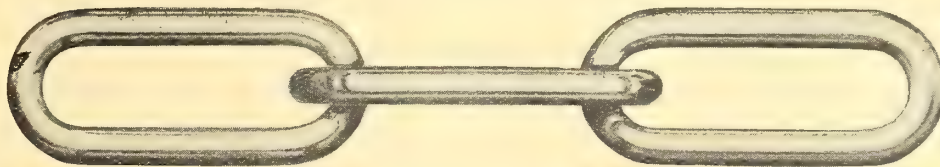
MANUFACTURERS

120 Adelaide W.

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Toronto, Ontario.



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TRANSFORMERS



TYPE "C"

High Efficiency

Low Core Losses

Good Regulation

For
Lighting and Power

YOU CAN ORDER PACKARD TRANSFORMERS FROM

St. John Railway Co.,	-	-	St. Johns, N. B.
Mechanics Supply Co.,	-	-	Quebec
J. S. Mitchell & Co.,	-	-	Sherbrooke, P. O.
General Supplies, Ltd.	-	-	Calgary, Alta.

Complete stocks also at St. Catharines, Ont. and our Warehouse at Winnipeg, Man.

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Factory: ST. CATHARINES

General Sales Office
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Phone M. 1002

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Substantial Transmission Line Construction

The Pennsylvania R. R. Co. to insure continuous operation on its Harrison cut-off transmission line, (33,000 volts) took the precaution of installing "Victor" Insulators throughout.

THE LOCKE INSULATOR MANUFACTURING CO.

Main Office—VICTOR, N.Y.
New York Office—50 CHURCH ST.
Works—VICTOR, N.Y. and LIMA, N.Y.
Engineering Equipment & Supply Co.,
410 St. James St., MONTREAL, QUE.

Pennsylvania R. R. Harrison
cut-off line.
Anchorage tower with No.
223 "Victor" Insulators.



Monarch Electric Company, Limited

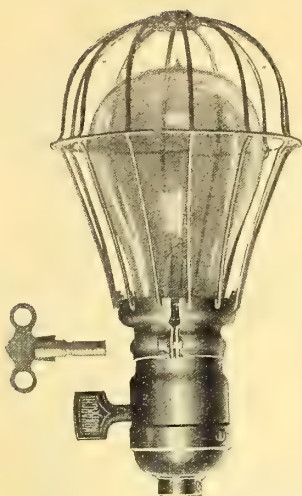
ST. LAMBERT, P.Q.

Phone: Main 3988
Montreal Exchange

Make one man responsible

for removal by using a

LOCK ON LAMP GUARD



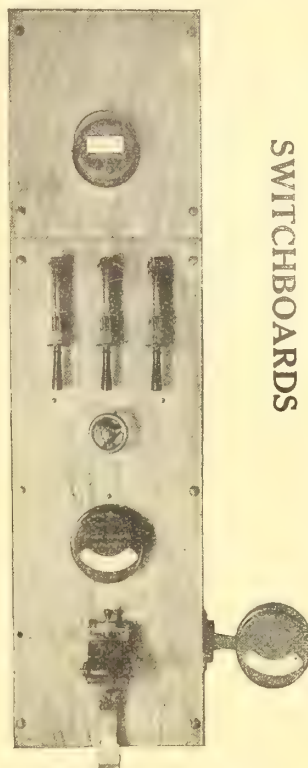
Insure your Incandescent Lamps
against LOSS, REMOVAL
and BREAKAGE

Electrical Supplies
Carried in
Stock

We would
Appreciate
an
Opportunity
to Serve
you

ROSETTES
SOCKETS
ATTACHMENT
PLUGS
PORCELAIN
SOCKETS
W.P. SOCKETS
Etc. Etc.

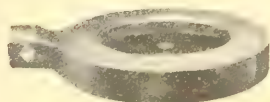
SWITCHBOARDS



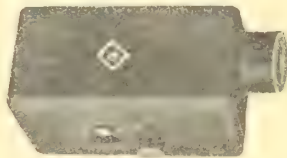
CONDUIT FITTINGS



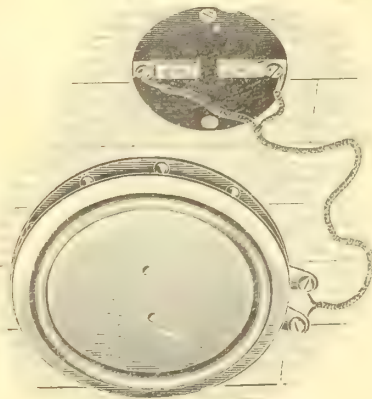
E 1/2-3 Wire Cover



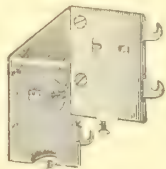
P 1/2



F D 1/2 Push Switch



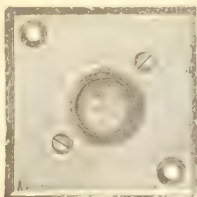
1150-Floor Tread



161 Spacer



171 Spacer



2685 Pearl Push



A 1/2-3 Wire Cover



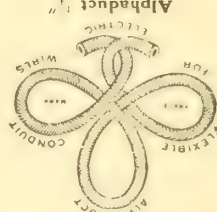
1/2 Fixture Stud



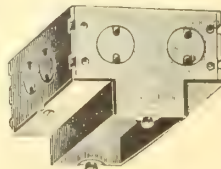
J 1/2 Receptacle



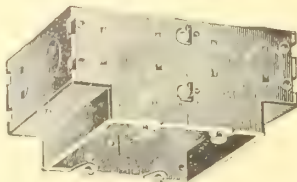
1/2 Pipe Strap



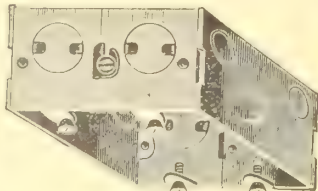
Alphaduct 1/2



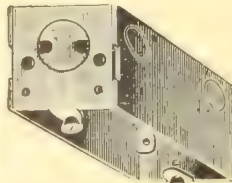
155 Switch Box



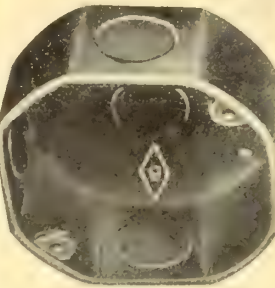
160-2 Gang Box



172-2 Gang



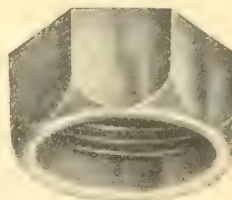
170 Comb Switch Box



6350-Outlet or Junction Box



1 Locknut



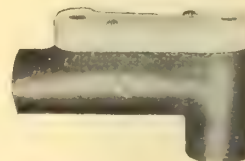
1/2 Bushing



K 1/2 Plug



1445-Reversible Guard



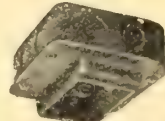
LB 1/2-2 Wire Cover



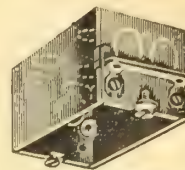
F 1/2-2 Wire Cover



1 to 1 Grounding Clamp



1915-Switch Box



C C S. I. Switch Box

Electrical Fittings Co. Limited
70 King Street West, TORONTO, Canada
British Columbia Agents, Cope & Son Ltd, 132 Water St., Vancouver, B.C.
"Made in Canada"

Write for Catalogue No. 3. If your Jobber cannot supply, write us.

WRITE FOR OUR NEW PRICES. THEY WILL SURPRISE YOU

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Electrical Works, Berlin, Germany

Metal Filament

AND

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Incandescent Lamps

Best in the World

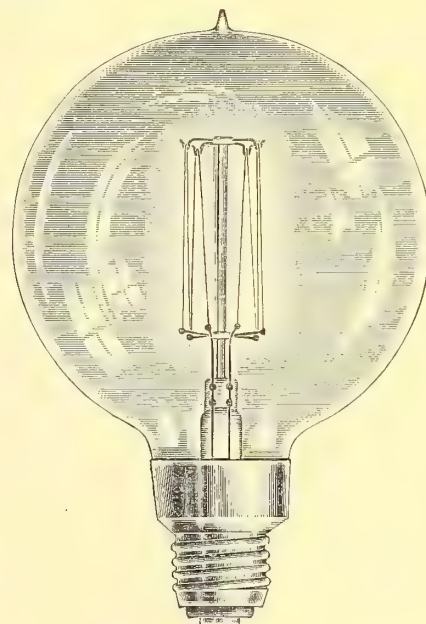
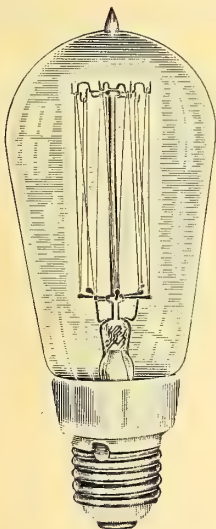
PROMPT DELIVERIES

Direct from Stock in any Quantities

Exclusive Distributing Agents for Canada:

P. H. KLEIN Jr., CO.
329 Craig Street West - MONTREAL

Auto and Battery
Tungsten Lamps



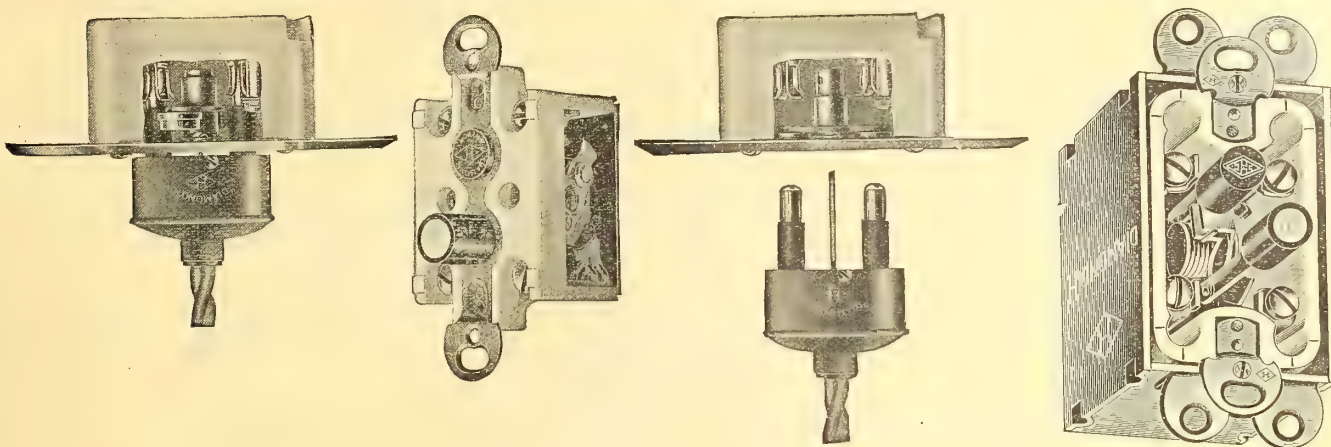
Look for the White
Porcelain Base

**Protect Your Investment in Switches by Specifying
"Diamond H"**

The "Diamond H" on a switch is valuable insurance—assurance that quality, materials and competent workmanship are embodied to perfect production.



The best protection for the user because they are dependable in operation. The safest investment for the dealer, engineer or contractor because they give satisfaction.



MANUFACTURED BY THE HART MANUFACTURING CO., HARTFORD, CONN.

Canadian Sales Agent:

C. W. Bongard, Toronto, Canada



No Contract too large for us to successfully handle!
 No Specification too close for us to work to!
 No Order too small for our prompt and careful attention!

Electric Glass Shades

We recommend high class shades
 because they are a perpetual ad.
 for any dealer, give a better profit
 and a larger turn over—

—and—

Please Your Customers Best

BUT

We carry and are pleased to ship all classes of cheap lines.

WE HAVE LARGE STOCKS OF

Tiffanies, Venetian, Decorated, Alabaster and Etched Shades, Silk Flex, Bell
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 Sole Canadian Agents for the W. K. Fixture Switch

The Canadian Tungsten Lamp Company Limited

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HAMILTON - - - - - ONTARIO

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 Toronto—123 Bay St., H. S. Dodd, Manager;
 AGENCIES: Vancouver—606 Granville St., Hinton Electric Co. Limited; Newfoundland—St. John's, W. A. Fisher (London);
 New Brunswick—St. John, O. H. Warwick (Co. Limited); Victoria, B. C., Hinton Electric Co. Limited;
 Quebec, P. Q.,—Mechanics Supply Company

The Canadian Tungsten Lamp Company
Lighting Experts
HAMILTON - - - ONTARIO
Limited

LIBERALLY BACKED BY THE MANUFACTURERS !
Why Encourage Inferior Imported Lamps
made by Cheap Foreign Labor ?

**Toughened
Filaments !**

**Increased
Efficiency !**

Reduced Price !



Longer Life !

No Blackening !

Quick Deliveries !

**Manufactured in Hamilton, Ontario, by Skilled Canadian
Workpeople !**



ELECTRICAL WIRES & CABLES

FOR ALL PURPOSES

Weatherproof Insula-
ted Copper, Iron and
Aluminium.

Bare Copper and Al-
uminium Wires and
Cables.

Copper Trolley Wire,
Round, Grooved and
Figure 8.

Rubber Covered
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Galvanized Tele-
graph and Telephone
Wire.

Galvanized Steel
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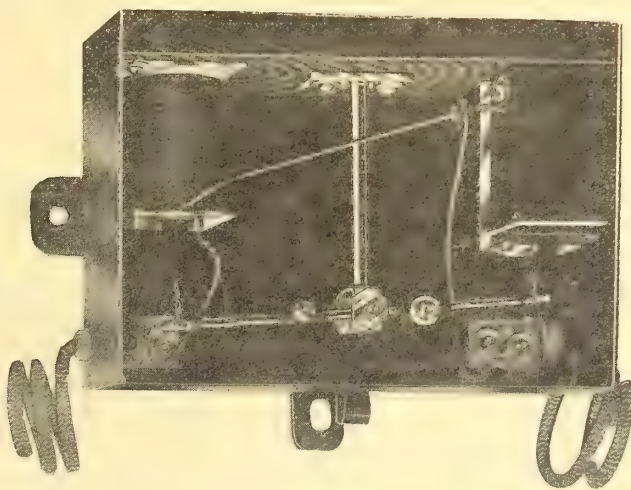
Canada Wire & Cable Co
1170 Dundas Street
Limited

TORONTO - CANADA

Overload Does Not Injure This Controller

THE SHEDRICK ELECTRIC LIGHT CONTROLLER OR LIMITER

Not Made
to
Last a Year
But a
Lifetime.



A
New
Departure
in
Controllers

Result of test of a ten light controller put in circuit with an overload of four lights (fourteen in all) with an average make and break of one hundred and twenty per minute (330,000 strokes)—more than any instrument would be subjected to in a lifetime—showed absolutely no injury in any way to Controller.

SATISFACTION GUARANTEED—WRITE TO-DAY FOR PRICES

Electric Specialties Manufacturing Company
157 Craig Street West, Montreal

C. & H. METERS

OUR A. C. METER has a higher torque and a higher ratio of torque to weight than any other A. C. Meter on the market.

It is supplied with ordinary or cyclometer counters as desired.

Ordinarily, it is supplied in a light cast-iron case which does away with stray-field errors, but it can be supplied in glass case if required.

It is made for any frequency, voltage, current and power factor and will maintain its accuracy even with considerable variation in any of these items.

Besides ordinary meters, we make Two-rate meters, Prepayment meters, Three-phase meters—in fact every sort of meter, not only A.C. but D.C. too.

TIME SWITCHES—We are also marketing the VENNERS Time Switches, with

which we have been associated in the Old Country and the world generally for many years. They are the only switches that have ever received government approval.

Mr. Stanley Lines, our permanent resident director for Canada, will arrive in Toronto about the middle of January.

Write him in care of Electrical News, 220 King Street West, Toronto, until further notice.

Solar Works : BIRMINGHAM, ENGLAND
Cablegrams :—"Solar, Birmingham"
Codes :— A. B. C. (5th Ed.), Western Union, Marconi, Private

CHAMBERLAIN & HOOKHAM, Ltd.

If Good Battery Service Interests You, Read This:

A truck, which has been operated for the past five years by G. E. Markley & Company, (Commission Merchants, Cincinnati, Ohio, now contains its third set of Gould Batteries, upon the installation of which the owners wrote us as follows:

"We have given the new battery a good try-out and it is working to our entire satisfaction. While the General Electric Vehicle Company truck on which it is used is of four tons capacity, we do not hesitate to put on five and six tons when in a pinch. The batteries have always moved the load as we wished."

None but Gould Batteries could give such service. No other make of battery has ever demonstrated a higher degree of reliability or an annual maintenance cost so low.

(Gould Batteries invariably give exceptional service because they are made in types expressly suited to the work to be done, and this is an advantage which only Gould Batteries possess. (Our separate types of batteries, each with distinct economy characteristics, and for special application and service, are superior in their respective fields.

Investment in Gould Batteries buys more mileage than can be secured from any other. Tell us what battery equipment you now have, and we'll explain exactly how this applies to your conditions.



Gould Storage Battery Co.

General Offices: 341-347 Fifth Ave., NEW YORK
 Works: DEPEW, N. Y.
 BOSTON, 89 State St. CHICAGO, Rookery Bldg.
 SAN FRANCISCO, Atlas Bldg.
 CLEVELAND, American Trust Bldg.

Bakelite Impregnated Wood

WOOD, particularly porous woods such as poplar, basswood and maple, can be so impregnated with the famous product **BAKELITE** as to be rendered hard and resistant to chemical and physical influence.

BAKELITE impregnated wood has an exceedingly high uniform dielectric strength, this being produced through the well known insulating properties of **BAKELITE**.

The importance of this for use on high-tension lines and throughout electrical work in general is great as the strength of wood, thus treated is increased and becomes an excellent insulator of electricity, withstands moisture, chemical solvents and is rot-proof. Where such wood has to be imbedded in cement or other conditions under which it is liable to attack from dry-rot, the advantages of the bakelized product are plain.

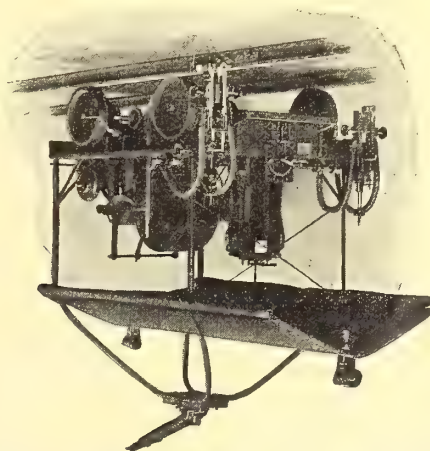
Afterwards if desired a beautiful high finish can be obtained with Bakelite Varnish, which resists the same actions as already mentioned.

We will give full information upon request of the many valuable uses to which bakelized wood can be put in electrical work. Write us.

Plastics Limited

Van Horne Street, Toronto

Electric Weld Rail Bonds



The conductivity of Bonds installed by our process can never be impaired by moisture or corrosion.

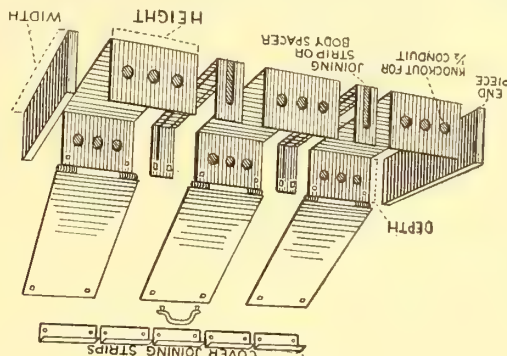
When once installed, they are on to stay and cannot be removed without actual mutilation and considerable hard work.

Write for Booklet

Electric Railway Improvement Co.

Office and Works, 6005 Carnegie Avenue
CLEVELAND

BOXES



With this system of "Bunny-Size" box it is unnecessary to keep a large stock of various sized boxes. Just keep a small supply of "Bunny-Size" parts and make up your different sizes as you require them.

Columbia Metal Box Co.

Northern Electric Manufacturing Co. Ltd.
Distributing Agents for Canada

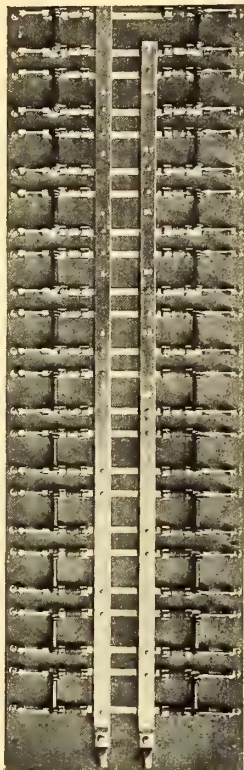
Devoo Panel

Now is the time for you to purchase the material for distributing current into the building you are wiring.

Devoo

Panelboards, Cabinets and Switches

will meet every requirement of the most particular purchaser, send us your next order and let us prove it.



The Devoo Electric Switch Company
Office and Factory: 157 Craig St. West, MONTREAL

"BRAIDUCT"

The indestructible flexible conduit is being specified by the progressive contractors throughout Canada from the Atlantic to the Pacific, because they have found it superior under all tests; it is moisture, weather and flame proof; quickly and easily installed; will not crack in zero weather and the cost is no more than for this st.

Order through the leading jobbers or direct.

The Flexible Conduit Co., Limited

Guelph, Ontario, Canada

"Noark" Primary Boxes

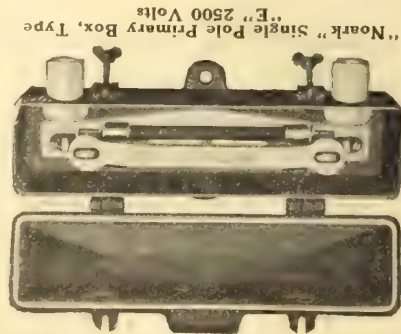
This line of boxes is designed with a view to overcoming all known defects in existing methods of transformer protection. The construction of the boxes is such that they will withstand the most violent short-circuit test. Indicating means is very sensitive and is of the "Noark" patented construction. The fusible elements are designed and calibrated to operate with great accuracy on overload.

A high factor of safety is employed in designing the insulation and leakage dimensions of these devices, and every box is tested at 100% of its working voltage before leaving the factory. The fuse block and carrier handles are made of porcelain. When it is desired to fuse the line, the fuse is inserted in the carrier handle and latched into place. The handle can not be detached from the fuse but remains inside the box until such time as it is desired to remove and replace the fuse.

Did you ever climb up a pole coated with ice in the dark during a sheet storm and fumble with the business end of a poorly insulated live fuse box? If so you will appreciate the value of the "Noark" carrier system. If not, ask your lineman.

These boxes are made in three capacities, 1-50 amperes, 61-100 amperes, and each capacity can be furnished in four ways:

(1) Bushings on the ends, (2) Bushings on the side, (3) 1 in unions on the ends, (4) 1 in unions on the side.



"Noark" Single Pole Primary Box, Type "E" 2500 Volts

THE CANADIAN H. W. JOHNS-MANVILLE CO., LIMITED

Manufacturers of Asbestos and Magnesite Products
Asbestos Hosiery, Packings, Electrical Supplies, etc.

TORONTO, ONT. MONTREAL, QUE. WINNIPEG, MAN. VANCOUVER, B. C.



(1119)

Conduits - Boxes - Fittings

For Rigid, Flexible Metallic and Flexible Non-Metallic
Thomas and Betts Conduit Boxes—Galvanized and Japanned.
Bushings and Locknuts—Flexible Conduit Fittings.
Fixture Studs—Solid and Hickey

Shipment from stock on all standard Conduit Boxes and fittings, ask us to send you Bulletin No. 2030.

We Carry in Stock a Complete Line of Electrical Supplies

THE Northern Electric AND MANUFACTURING CO. LIMITED

Manufacturer and supplier of all apparatus and equipments used in the construction, operation and maintenance of Telephone, Fire Alarm and Electric Railway Plants. Address our nearest house:

MONTREAL, TORONTO, WINNIPEG, REGINA, CALGARY, VANCOUVER



Central Electric & School Supply Co., Limited

36 Adelaide St. West, - TORONTO, ONTARIO

Electrical Supplies of Every Description

A few of our specialties:—

Moloney Transformers
Rigid and Flexible Conduit
Condulets

LARGE STOCK PROMPT SHIPMENTS

Write for Catalogue No. 3

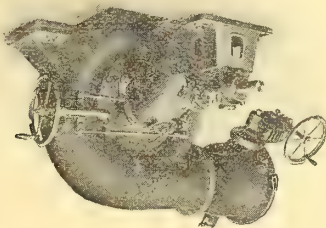
John Starr, Son & Co.
Limited
158 Granville St. - HALIFAX, N. S.

Electric Lighting Supplies

LAMPS, SOCKETS, ROSETTES, WIRES, CORDS,
CONDUIT, MOULDING, SWITCHES, CUT-
OUTS, FIXTURES, ETC., ETC.

Large Stocks - Prompt Shipments
Write Us for Low Prices

Water Power Plant



Type 30 Francis Turbine
1000 B.H.P. 120 Feet Fall

Pipe Lines, Governors, etc.

Apply to

James C. Gordon & Co.
81 and 83 Knightbridge Street
LONDON, - ENGLAND

1911 Greetings 1912

*We Wish our many
Customers and Friends
A very Happy and Prosperous
New Year
and trust the year 1912 will bring
them what they most desire.*

We take this opportunity to thank our
customers for past favors and hope, by
our continued efforts to give prompt and
careful attention to their orders, and by
shipping good material at right prices, to
receive the further continuance of their
valued favors.
To those who are not yet our custom-
ers, we trust they will be during 1912.

Dawson & Co., Limited
Montreal - Winnipeg

IN THE PATH OF PROGRESS REGENERATIVE FLAME LAMPS

are the most efficient artificial illuminant ever produced. For the lighting of large areas and the general illumination of foundries, mills and industrial plants of all kinds, it is now accepted as standard. It is simplicity personified. It is mechanically strong and has had an average life of more than 70 hours. For four years, you will be interested in learning more about this lamp. May we demonstrate it to you?

ABOLITES

are the latest development in scientific illumination. There are two kinds. Commercial Abolites for the lighting of stores, office buildings and the like; industrial Abolites for the lighting of industrial plants of all kinds. There is nothing just like the Abolite. It performs the function of socket, shade holder, insulating joint and suspending fixture. Above all, the patented positioning device provides for all lengths of lamp base and eliminates all form of separable shade holders. The Abolite is many in one. Write us your conditions, we can help you.

The Adams-Bagnall Electric Company, Cleveland
New York Philadelphia Syracuse Pittsburg Chicago Atlanta
R. E. T. Pringle, Canadian Representative, Windsor, Ont.
Branch Offices: Montreal Toronto



Porzellanfabrik Hermisdorf

Sachsen-Altenburg, Germany

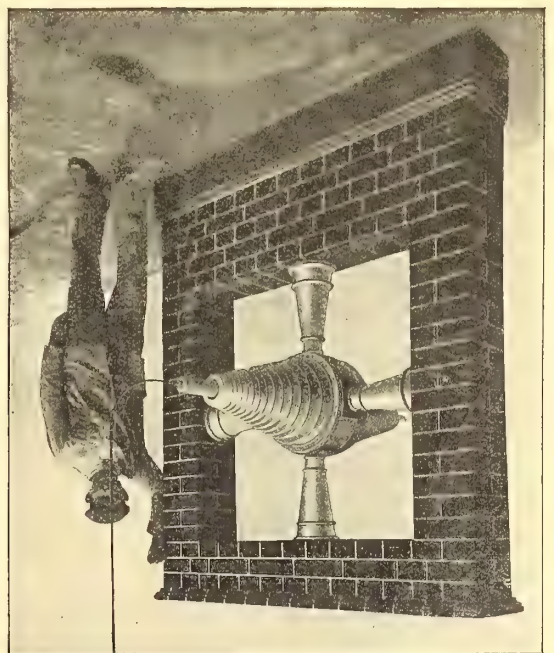
Wall Duct for the High Tension
Transmission Station of the

Hydro-Electric Power
Commission of Ontario

110,000 Volts

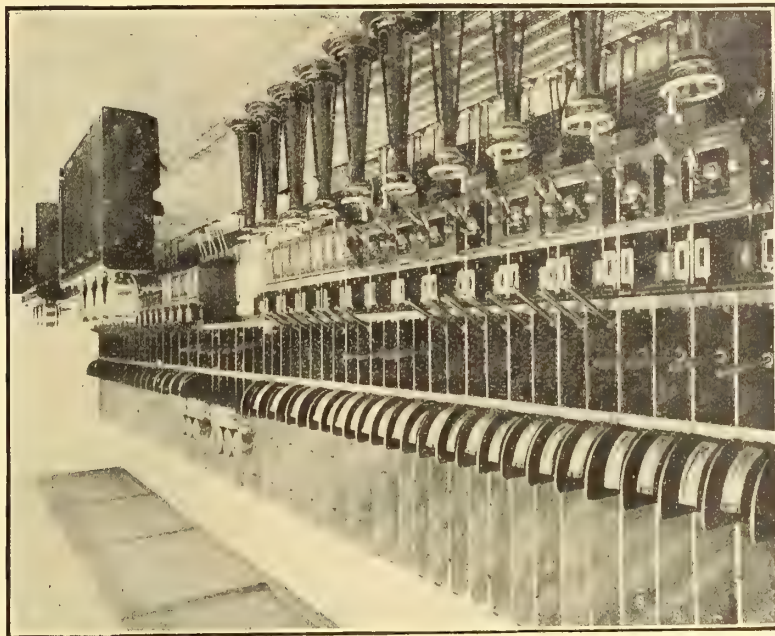
Sole Agents for Canada

Watson Jack & Company
709 Power Building, MONTREAL



FERRANTI LIMITED

ELECTRICAL and
GENERAL ENGINEERS



Manufacturers
of
Complete
Switchboards
D. C. & A. C. up
to 60,000 Volts.
Transformers
Auto Starters
Switches
Circuit
Breakers, etc.

Reliable
Operation
Substantial
Construction
combined with
Accuracy
and
High Class
Finish

Canadian Representative — G. C. ROYCE — West Toronto, Ontario
If you are in the market for any kind of electrical equipment—send us your specifications and let us quote you.

Indirect Lighting

The "Eye-Comfort" System of indirect illumination is being installed in most new Bank, and Office Buildings, Churches and Auditoriums.

The mellow light given by this method is truly an "Eye-Comfort."

Our Literature contains illustrations of many notable installations of the "Eye-Comfort" System.

Send Us Your Address.



National X-Ray Reflector Co.,
214 JACKSON BLVD. CHICAGO

Worcester Electric & Mfg. Co.
WORCESTER, MASS., U. S. A.

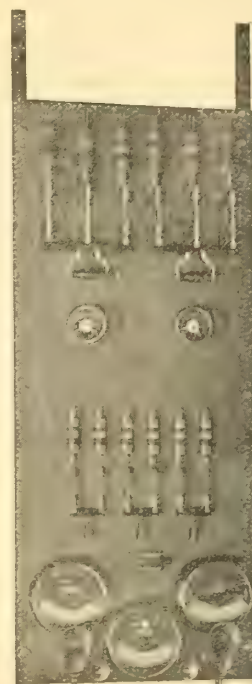
A. C. and D. C.

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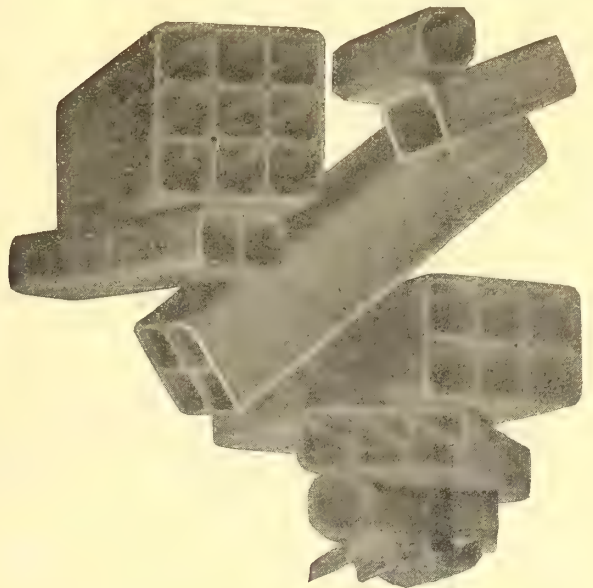
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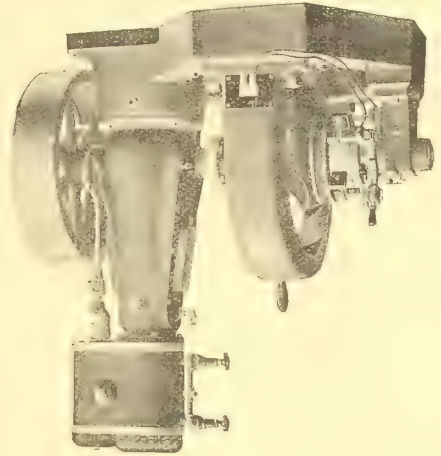


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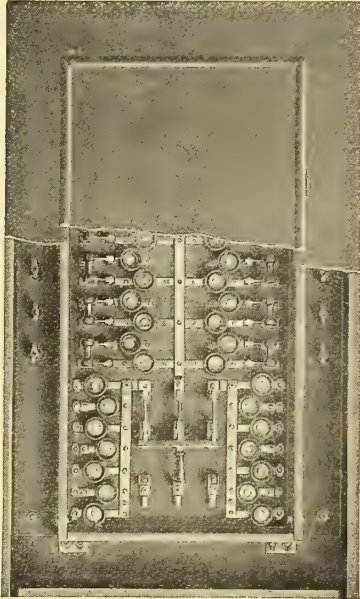
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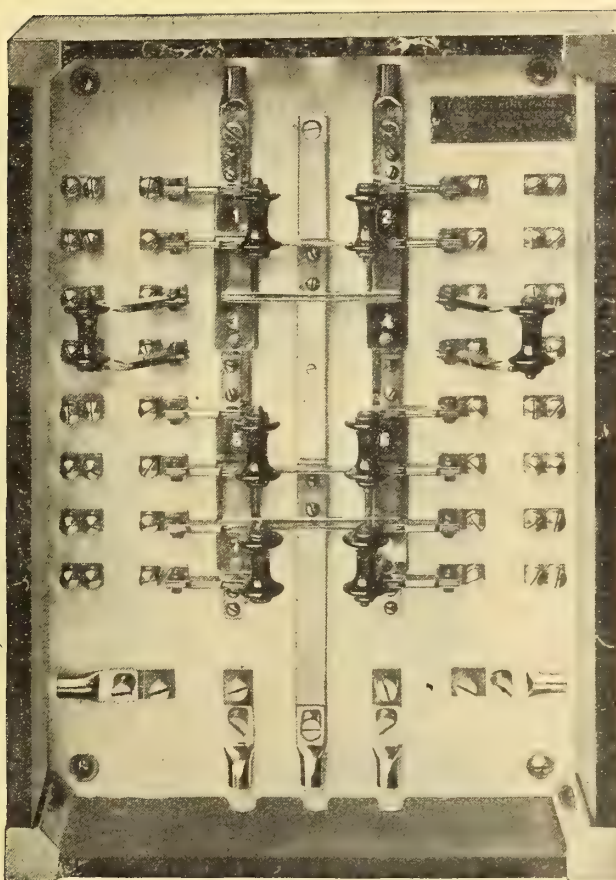


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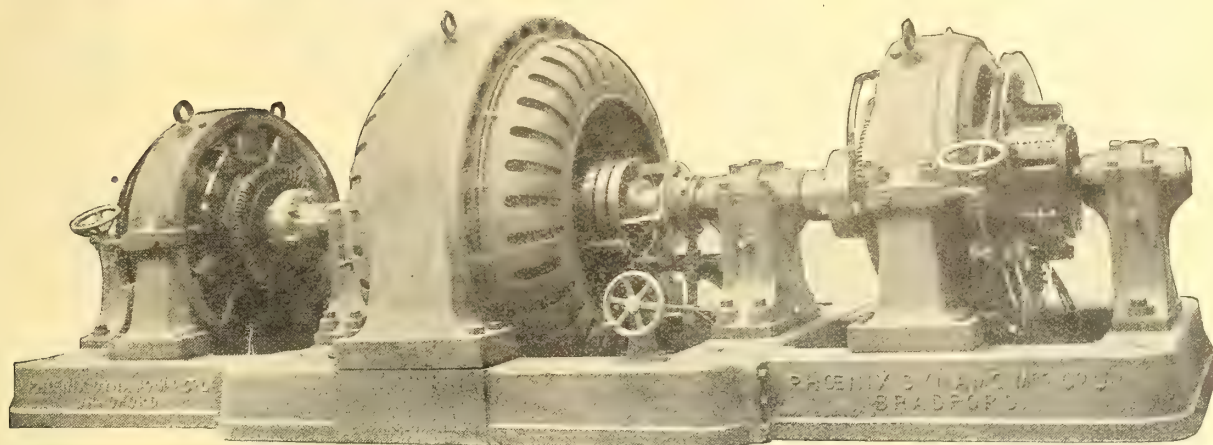
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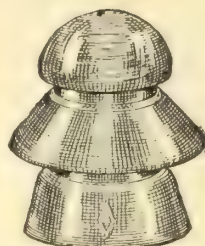
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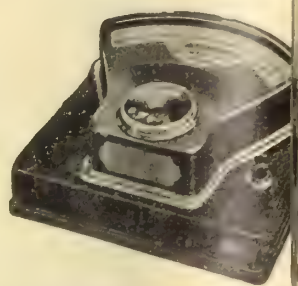
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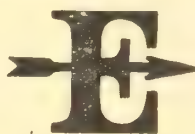


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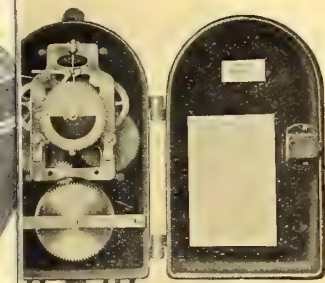


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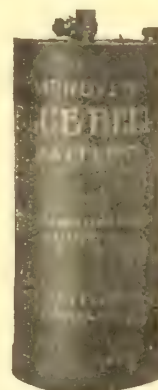
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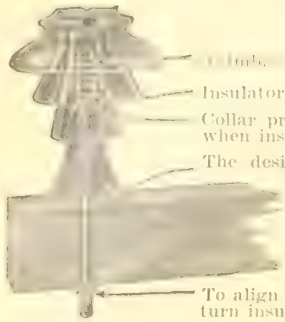
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 Insulator screws to stud bolt here.
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 The design of the base prevents turning, adds greatly to the strength, and prevents rotting of the wood at the bolt holes.
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The Improved Truss Pin

Its construction is simple; it is carefully designed and made; bases are designed for maximum strength and to conform to the shape of the cross arm; this latter gives added strength to withstand lateral strains, prevents turning, and eliminates rotting of the wood at the bolt holes.

It is easy to put up; easy to replace damaged insulators; easy to align with the wire; many more advantages will present themselves to you for your own conditions.

Wherever cemented insulators are used, use the Improved Truss Pin. It pays.

If you ask for our new book "THE IMPROVED TRUSS PIN," we'll send you a book that will be of much value to you. Ask for your copy now.

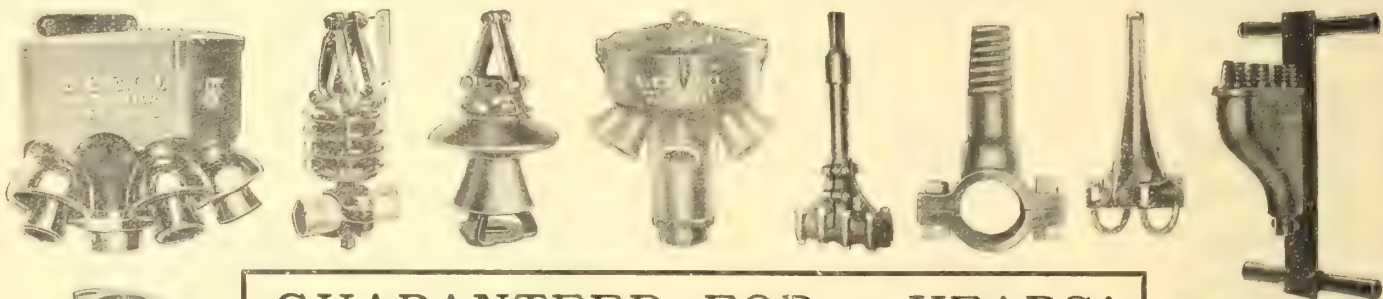
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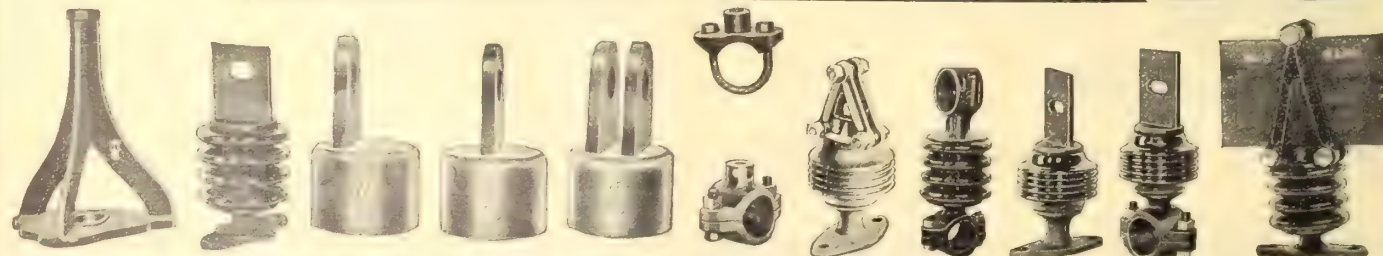
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Electrical News

Generation, Transmission and Application of Electricity

PUBLISHED MONTHLY BY

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Correspondence is invited upon all topics coming legitimately within the scope of this journal. Subscribers can materially assist by sending in news items and information regarding electrical development in all parts of Canada.

Vol. 21

Toronto, January, 1912

No. 1

Sow the Wind, Reap the Whirlwind

It begins to look as if the electrical distribution system being installed by the municipality of Toronto will tax the city, both as to first cost and later maintenance, out of all proportion to any revenue that, according to present indications, there is any likelihood of receiving from it in the near future. Already there has been voted \$2,750,000, and the ratepayers are being asked with the new year to vote an additional \$2,200,000, which will bring the total amount up to \$5,000,000.

Calculate roughly the annual maintenance of this system: Interest and sinking fund on five million dollars amounts to approximately six per cent., or \$300,000. The present office expenses, including officers, business solicitors and so on (requiring some 250 men, all told, it is said) could not well be less than \$200,000. Operating expenses, including operating engineers, patrol men, men replacing broken lamps, cleaning globes, etc., together with the cost of this apparatus, will probably mean as much more or (say) \$150,000. At the present moment it is reported that approximately 5,000 h.p. is being used which is costing, at \$18 per h.p., \$90,000 per annum. This already totals up to an annual expenditure of \$740,000, without allowing anything for depreciation. In any well managed system, whether private or municipally owned, it is considered no more than good business that five per cent. at least of the original cost must yearly be set aside for depreciation. This is another \$250,000, which brings the total up to \$990,000, close to a million. This estimate is probably well within the facts.

The present revenue, on the supposition that power will

be sold in the neighborhood of \$30 per h.p., supposing that 5,000 h.p. is used, amounts to \$150,000, so that up to the present moment the revenue is not more than 1/6 of the actual yearly cost of operating the system. It must be remembered, too, that this is practically all utilized on the streets. Further, only half of the street lighting has been installed, so that when the equipment is completed we may expect that Toronto will be using 8,000 to 10,000 h.p. on its streets alone.

The actual amount being already used on street lighting is reported as 4,500 h.p., which is costing, at \$30 per h.p., the sum of \$135,000. It would be a very conservative estimate to place maintenance, depreciation and operating expenses at as much more, which would place the total yearly cost of the present unfinished street lighting equipment at \$270,000. Perhaps it is not fair to judge results by the present illumination effects, but opinions are being freely expressed that, to date, it is no improvement in quantity over the old arcs. And the yearly cost under the arc system was less than \$120,000. This works out that Toronto is now paying for its street illumination much more than double what it paid to the private corporation. And the system is only half installed.

It is a little surprising too that the private load of Toronto's municipal system has not picked up at a much more rapid rate. It is well known that there is a very large number of business canvassers in the employ of the city and yet we are told that the number of customers only reaches somewhere in the neighborhood of 4,000. It is reasonable to suppose, too, that a very large percentage of these were waiting, had been waiting, for months, to sign contracts as soon as presented. So far this has been easy money, but business that is brought in after the first year is only going to come from sources where it is necessary to convince the consumer that the city system possesses advantages the private system does not possess. In other words the municipal system is reaping the benefit of sentiment during the first year, but might expect that only hard business methods will result in increasing the revenue after that time.

It is more than doubtful whether the Toronto scheme would have had such willing support if it had been announced, in its inception, that the street lighting equipment would consume well up to the full 10,000 h.p. Be that as it may, while other cities throughout Canada are all boasting, each in their own local press, that they are the best lighted cities in the Dominion, it would appear that Toronto will soon have the distinction of being able to boast, without fear of contradiction, that it is the most expensively lighted city in Canada.

Three per cent. Voltage Drop in 273 Miles

Mr. P. W. Sothman, chief engineer of the Ontario Hydro-electric Power Commission, recently switched over the lines covering south-western Ontario in such a way as to obtain one continuous transmission circuit of 273 miles. The current was transmitted from Niagara Falls to Dundas, to Woodstock, to London, to St. Marys, to Stratford, to Guelph, back to Dundas, on to Toronto, back to Port Credit, back to Dundas, making the total distance of 273 miles. Over the first 242 miles of this circuit transmission was at 110,000 volts, but at Port Credit the voltage was stepped down to 13,200 volts and transmission was made from Port Credit back to Dundas, a distance of 31 miles over the 110,000 volt line, but at 13,200 volts.

This test was made by engineer Sothman with a view to determining the drop in voltage over a line of so great a length. To this end two instruments uniformly calibrated were placed side by side in the Dundas station, one of these being connected with the local low tension line,

and read 13,200 volts, the other being connected with the low tension line when it returned from Port Credit after transversing the full length of the 273 miles. The second instrument read 12,800 volts a drop of only 3 per cent. It is worthy of note too that the last 31 miles of the course was at the lower voltage where a considerable portion of the loss might naturally be expected to occur though the larger-sized wires would tend to hold up the voltage to some extent.

As further confirmatory evidence that this distance is well within the range of satisfactory transmission at 110,000 volts, Mr. Sothman states that the test was made without knowledge of any of the engineers-in-charge along the line at the various stations. While the test was being made these operators were telephoned for a report on conditions and without exception replied that everything was quite satisfactory and normal. To the very last station no operator had noticed any appreciable fall in the voltage of the line. The load on the line at the time of the test was approximately 8,000 kw.

Value of Auxiliary Plants

A strenuous competition is under way between the Winnipeg Electric Railway Co. and the Winnipeg municipal plant. A factor which is undoubtedly going to tell in favor of the private plant is the fact that they already have an auxiliary steam plant ready for call at a moment's notice if anything should go wrong with the hydro-electric plant. This auxiliary approximates 20,000 h.p. and will be a powerful argument in the competition between the two systems. The continuity of a hydro-electric plant at best is uncertain and the system which is backed by a large auxiliary plant stands to win in the competition for business.

Simultaneously with the announcement of the city's low residence rates the company state that they will meet these prices at every point and in drawing attention to their unusual facilities for maintaining continuity in their service publish the following statement:

"The company wishes further to draw the attention of its present and future customers to the important fact that they will have completed within the next few days and ready for operation, an additional steam plant, making the total capacity of its two steam plants approximately 20,000 h.p. as an auxiliary plant, which has been constructed in order to guard against any serious interruption of their hydro-electric plant. This will insure all customers of the company against any serious inconvenience or loss from break-downs either to the water power plant or to the transmission line that would cause serious interruption to the distribution of current from the hydro-electric plant."

Tallest Concrete Stacks

The completion of the second auxiliary steam plant for the British Columbia Electric Railway Company in time to take some of the extra load incidental to the holiday season brought great relief to the officials of the company and to Contractor C. C. Moore, of Seattle. The latter was under heavy bonds to have the installation of the steam generating machinery and dynamos complete by Dec. 18th, but in case of failure no penalty could possibly have compensated the company for the disappointment of customers who would have suffered from a lack of power at the Christmas season.

The huge concrete smokestack of the second steam plant, built at the rate of six feet per day, has the distinction of being both the tallest in the Dominion and the largest one for any steam plant, the total height being 252

feet from the foundation and 240 feet, 6 inches above ground. Together with its sister stack, less than one hundred feet away, the new stack is likewise notable in being the only one built entirely of concrete, reinforced vertically with half-inch iron. At the base the outside diameter is 14 feet, and for the first 80 feet the stack has a double shell, the air space being designed to take care of the intense heat generated in the furnace. At a height of 86 feet the outside diameter of the stack reduces to 12 feet, with an internal diameter of 11 feet. The total cost of the new smokestack was \$16,000.

Three crews of men were engaged night and day on the installation of the steam plant machinery, so as to have it in shape to start up Dec. 18th, the date fixed by the company. The four boilers, each 500 h.p. capacity, were in place early in the month, and the installing of the 2,000 kilowatt Allis-Chalmers-Bullock alternating current generator followed. This plant will increase the available electrical horse-power generated by steam from 10,000 to 12,000, and give a reserve of power which is badly needed at present during rush hours. The total cost of this second addition to the steam plant, including both stacks and machinery, is \$250,000. It is expected to be the last investment the company will make in steam generating machinery, as, with the completion of the company's power dam at Lake Coquitlam, a sufficient storage of water will be secured to enable the capacity of the generating station at Lake Buntzen to be increased to 80,000 horse-power.

The Winnipeg Rate Situation

After much discussion the city council of Winnipeg has adopted a 3c. rate for civic light with a minimum charge of 50c. for monthly accounts. It will be remembered that in the prospectus originally issued dealing with the probable cost of electric light in Winnipeg if a municipal plant were built, it was claimed that energy could be delivered to the citizens at about 3c. per kw.h. However, as the cost of the plant came to be more fully realized it was seen that this was an absurdly low rate and that it would be impossible to operate at this rate except at a considerable loss. When manager Rossman took hold he apparently realized this sane point of view and adopted a price of about double the amount now fixed. The Winnipeg press however, and numbers of the citizens, with an apparent disregard of the business features of the situation, have agitated for an adherence to the original prospectus and finally forced the council to submit. There was far from being a unanimity of opinion in the matter as is shown by the attitude of one of the aldermen who made a strong plea for the operation of the system as a business proposition. This alderman is reported as follows:—

"Ald. Fowler then went on to prove by figures that the earning power of the plant at the rate now proposed would not be sufficient to cover the expenses of running. He wished for the best terms possible, but at the same time he stood for running at actual cost."

It is difficult to see what single justification there can be for running a plant at less than actual cost, a course which makes one portion of the citizens which do not use electricity in any form pay the bills of the other portion. The only excuse seems to be a vindictive desire to kill out the private company, though in this case it may be taken as a foregone conclusion that the private company is well able to take care of its own business. If the unbusinesslike methods adopted by the municipality in fixing the rates in Winnipeg are any criterion of the general methods to be adopted in the management of this system the Winnipeg Electric Railway Co. will have little to fear from its competition.

Will Duplicate Niagara-Toronto Line

The directors of the Toronto Power Company have decided on the completion of the power house of the Electrical Development Company at Niagara Falls, Ont., the completion of the generator equipment there and the construction of a second transmission line from Niagara Falls to Toronto.

It will be remembered that the original plan of the power house calls for a very artistic appearing building, only the central portion and one wing of which has been completed up to the present time. It is understood that the second wing will be built as soon as the materials can be got on the ground. The splendid appearance of this power house, which is one of the finest buildings we have in Canada, is due in large measure to the artistic proclivities of Mr. Frederic Nicholls, who has taken the greatest pleasure in producing something that Canadians may well be proud of.

At the present time only six generators are installed with a seventh practically completed. The final plan calls for four more, and these will be installed within the near future.

The second transmission line, which will be built at once, will be in large measure a duplicate of that already existing. The voltage of transmission will, however, be 85,000 instead of 60,000 volts. Mr. W. B. Boyd, chief electrical engineer for this company, will have charge of the construction details in these extensions.

Manitoba Increases Telephone Rates

The Manitoba Government Telephone Commission has announced a new schedule of rates which for new subscribers will go into effect on Jan. 1, but for old subscribers not until April 1, 1912. The new plan of charging is along the line outlined in last month's Electrical News. Business telephones will now cost \$4 a month for which 100 calls are allowed; calls in excess of this amount must be paid for at the rate of 2c. each. Residence telephones will cost \$1.50 a month which allows 30 calls; anything over 30 must be paid for at 2c. each. A house telephone on which an unlimited number of calls may be made will cost \$4 a month. Party lines are abolished and accounts are payable monthly.

As compared with the old rates which were \$25.00 for residences and \$50.00 for business telephones this will be considered an increase in the rate by a majority of telephone users. Of course to the customer who uses his telephone only once a day the new system will be cheaper but it is safe to say that few people go to the expense of installing a telephone who only want to make one call a day on it. The plan of paying in proportion to the value received is undoubtedly along the right line but the rate should be fixed so as not to discourage the use of the telephone. It is unfortunate that the Government of Manitoba finds itself in a position where it is necessary to raise its rates to a point such that the average housewife will think twice about making her necessary business calls. As far as business houses are concerned the new rates will doubtless mean, in many cases, an increase in telephone expenses to four or five times that paid under the old rates.

Contracts Let at Carillon Falls

Judging from the various schemes which are being promoted, Montreal will in a few years have abundant power supplied by hydro-electrical plants. Work on a big scheme at Carillon Falls has just been commenced, the contract having been let to the Carillon Construction & Development Company, Limited, of Montreal, by the National

Hydro-Electric Company, Limited. This calls for the installation of the first two units of the plant, which will develop and transmit to Montreal 40,000 horse power of electrical energy; ultimately the company will have 160,000 horse power available. It is the purpose of the National Hydro-Electric Company to furnish power in large blocks ultimately to the larger manufacturing interests and railways. The Canadian Pacific Railway connects at Point Fortune, just opposite Carillon, with the Montreal-Ottawa line, and Carillon will, therefore, be well furnished with railway communication with the outside world.

The cost of the complete scheme is placed at \$5,000,000. The work now being done will, it is hoped, be so far advanced by August, 1912, as to be able to furnish power for the blasting, tunnelling, etc. Rock cutting and crib work for the head race will be among the first undertakings. The Hydro-electric Commission of Ontario has shown some interest in the development of this power, and it has been proposed to connect with the Commission's lines of transmission to supply power to several of the Eastern Ontario cities. This would necessitate the building by the Commission of about 100 to 125 miles of transmission lines.

The president of the National Hydro-Electric Company, Limited, which was incorporated in December, 1910, is Mr. Henry Miles; Mr. Arthur Lyman is president of the Carillon Construction & Development Company, and Mr. F. S. Mason, of New York, vice-president. Mr. A. G. Watts, lately of the Shawinigan Water & Power Company, is engineer of the work now in progress at Carillon.



Electrically Operated Cranes

On another page in this issue will be found an interesting article by Mr. C. S. Mallett on the results obtained from a couple of installations of electrically operated cranes for freight sorting and handling in which Mr. Mallett is endeavoring to interest managers of factories, railway superintendents and others having large quantities of freight to handle by placing before them much authoritative and valuable information. There is no doubt that the number of places in Canada where an installation of this sort would prove exceedingly helpful are legion, and to those concerned in this work it is certain that nothing but good could result from a careful investigation of the matter set forth in this article.

We have no doubt that Mr. Mallett in his mission to procure the installation of apparatus which will perform much more and much better work will receive the consideration his valuable apparatus justifies. The present moment in Toronto would seem to be an opportune one for the opening of this important question where both trouble and delay are caused by apparently inadequate facilities, on somebody's part, in the handling of incoming freight. A further great advantage which this apparatus possesses is its applicability to buildings which are already constructed and the small space required for its efficient installation and operation. This is especially true of this firm's overhead travelling cranes, which have usually from two to three tons lifting capacity, with a fairly high speed. A crane of this type can be placed in a building where the distance from the roof trusses to the underside of the crane bridge girder does not exceed 30 inches.

Saraguay Electric Under New Control

The Saraguay Electric and Water Power Company, Montreal, has passed into the control of the Canadian Light and Power Company, which acquires a business of considerable magnitude. There are about 1,600 customers, of which 600 are within the city limits. The company owns franchises in St. Laurent, Notre Dame de Grace, Cote des Neiges, Cartierville, Bordeaux, Ahuntsic, Sault aux Recollet, Longue Pointe, Tetreautville, Pointe aux Trembles, and the City of Montreal. With the exception of the City of Montreal, Notre Dame de Grace, Cote des Neiges and Longue Pointe, the franchises are exclusive.

The Saraguay Company will, for a certain time, at any rate, be continued as a separate concern, with the present officials in charge. The old board of directors was composed of Messrs. Gaspard Deserres, president; G. M. Bosworth, Tancard Bienvenue, H. Laporte, William Wainwright, T. Bastien, Hon. Hector Champagne, of St. Eustache; E. Champagne, managing director; Hon. J. A. Ouimet, Alphonse Racine. Ed. Hurtubise was secretary, and Charles Brandeis chief engineer. As the result of the change the new board has been appointed as follows: E. A. Robert, president; Gaspard Deserres, vice-president; E. Champagne, managing director; K. B. Thornton, R. N. Smyth, F. J. Shaw, and T. Bastien.

The company's power house at Cartierville has been partly destroyed by fire and some of the plant damaged. There was fortunately only a slight interruption to the service, power being secured from the Canadian Light & Power Company. The Saraguay Company has had under construction for some time a new station, 185 x 80 feet. The plant will develop 4,000 horse power, steam turbines being installed.

Quebec Water-Powers to be Leased

Notice has been given by the department of Lands and Forests, Quebec, that on May 14th, 1912, a number of water-powers will be offered at auction. The number of water-powers to be so disposed of are fifteen in number, and vary in size from 130 h.p. up to 19,000 h.p.

Leases will be granted for a term of seventy-five years. Two years is allowed the lessee for the beginning of the works and two years more for the production of power. A statement of the production of energy shall be submitted to the government twice a year and certified under oath by a qualified officer. If deemed necessary the Minister of Lands and Forests may appoint a properly qualified person who will have access to the books of the lessee. The rates and terms of leases are to be adjusted every twenty years. A royalty is to be paid for each horse-power developed, also an annual rental, to be determined by the bidding on the upset price.

The following table indicates the size and location of the water powers with the amount of deposit, the royalty per horse-power and the upset price in each case.

Minimum h.p. to be developed	Minimum theoretical horse-power	Names of Falls or Rapids.	Place	Amount of Deposit	Royalty per h.p.	Annual Rental (upset price)
235	475	Lac aux Ecorces	Riv. Kiamika, Co. Ottawa	\$ 300	10c.	\$ 50
2,500	19,000	Grand Chute a l'Ours.	Riv. Ashuapmichuan, Co. Lac St-Jean	10,000	15c.	1,400
250	500	Riv. Assemetquagan	Pres Riv. Matapedia, Co. Bona- venture	300	12c.	50
2,150	4,300	Chute des Galets	Riv. Shipshaw, Co. Chicoutimi..	2,500	10c.	300
240	475	Rapide Rickaby	Riv. Batiscan, Co. Champlain...	300	10c.	50
600	1,260	Riv. Batiscan	Pres Riv. Jeannotte, Co. Champlain	700	15c.	100
600	1,200	Chute des Iroquois	Riv. Vermillon, Co. Champlain..	700	15c.	100
900	1,800	Rapide de l'Orignal	Riv. du Lievre, Co. Ottawa ...	1,000	15c.	150
250	500	Riv. Eaux Mortes	Canton Hackett, Co. Champlain	300	15c.	50
65	130	Lac Kiamika	Co. Ottawa	100	15c.	25
4,000	8,000	Rapides Pont Ellis	Riv. Ashbuapmichuan, Co. Lac St-Jean	5,000	15c.	600
3,300	6,600	Chute de la Maritine	Riv. Metabetchuan, Co. Lac St- Jean	4,000	10c.	500
300	600	Grande Riv. Bostonnais	Co. St-Maurice	400	10c.	50
425		Riv. Batiscan... ..	Village N.-D. des Anges, Co. Champlain	500	15c.	100
7,000	14,000	Riv. Aux Outardes	Co. Saguenay... ..	7,000	10c.	1,000

First Unit of New Shawinigan Plant Operating —20,000 H.P., 100,000 Volts, Steel Towers —High Safety Factor Throughout

The Shawinigan Water & Power Company have recently put into commission the first unit in their new 75,000 horsepower plant at Shawinigan Falls on the St. Maurice River, 85 miles out of Montreal. The company has also constructed a second transmission line along which they are transmitting at 100,000 volts. Work was commenced on this new power house and on the steel tower transmission line and new sub-station in Montreal early in 1911 and the first unit was put in operation on November 7th last. This represents pretty close to a record in construction work. A second unit is practically ready for operation.

These first two units consist of I. P. Morris turbines of the twin-spiral case type, having a capacity of 20,000 horsepower each and an operating speed of 225 r.p.m. under a 145 foot head. The generators connected to these turbines are Canadian Westinghouse manufacture, rated capacity each 14,000 kv.a., 2-bearing water-wheel type, 6,600 volts, 60 cycles, 3-phase, 225 r.p.m., and have a full load efficiency of 96.8. These machines are provided with motor operated field rheostats and motor operated field discharge switches. One 400 kw., 125 volt, 2-bearing direct-connected water-wheel type, shunt wound, 580 r.p.m. exciter has been installed, also one 400 kw. motor-generator exciter set of the same characteristics, including the necessary step-down transformers for the induction motor.

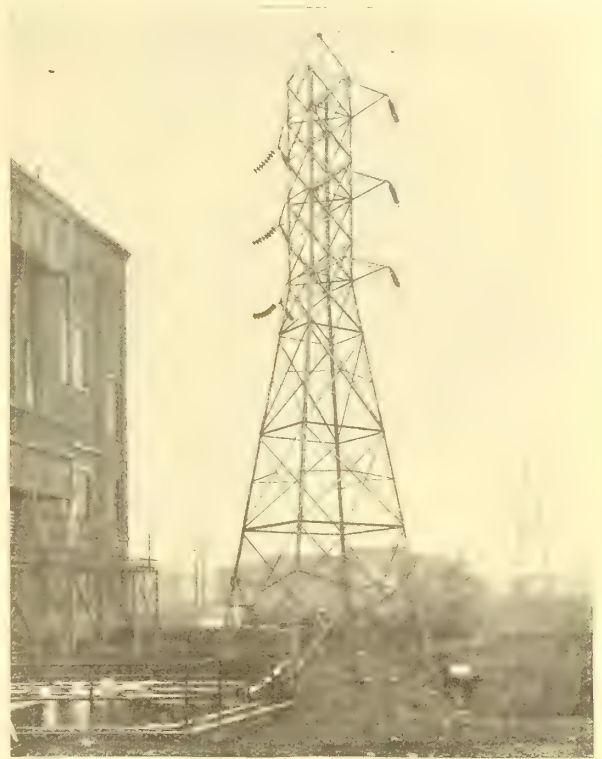
The two main generators are said to be the largest of this slow speed water-wheel type that have ever been installed in the world. They were designed and built complete in the Hamilton shops.

Forming part of this first equipment is a step-up transformer, 3-phase, 60 cycle, oil insulated, water-cooled type, having a ratio 6,600 to 100,000 volts and a capacity of 14,000 kv.a.

The new transmission line to Montreal consists of double circuit towers, only one of which circuits is yet in use. The towers are metal structure, 70 ft. high with 20 ft. base, manufactured according to the Shawinigan Company's specifications by the Canadian Bridge Company, and were assembled and erected by the Shawinigan Water & Power Company. The transmission cable is 250,000 c.m. in cross-area with two $\frac{3}{8}$ -in. steel cables for lightning protection. The towers are placed 520 feet apart. Suspension type insulators are

used, each insulator consisting of seven 10-inch, Ohio Brass type, disc units. The strain type consists of 8 such discs. C. G. E. electrolytic lightning arresters are installed at both ends of the line.

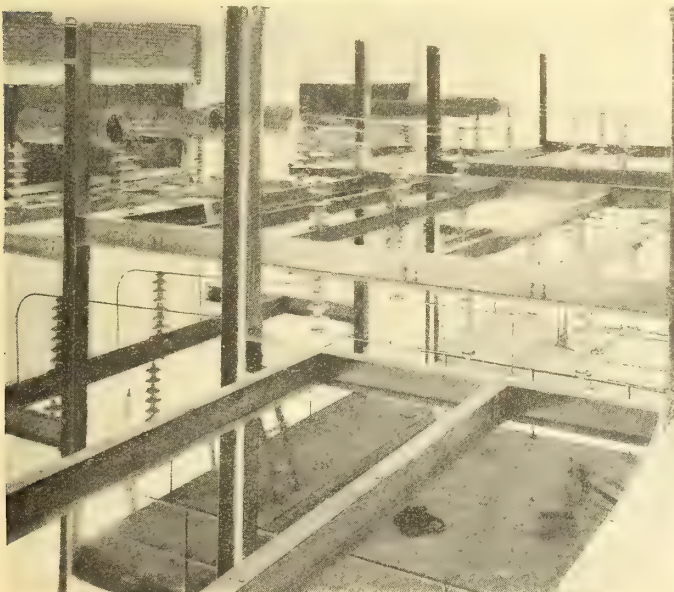
A prominent idea in the design of this new plant has been to make each unit from the turbine to the terminal station at Montreal complete in itself. Thus there is a



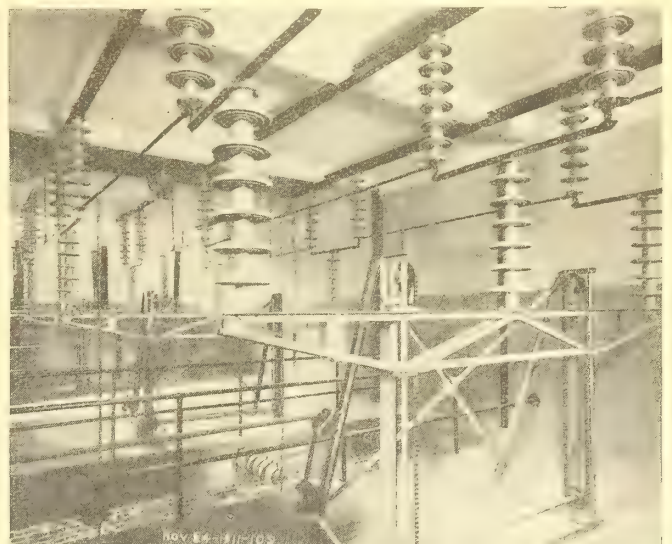
Terminal Tower—Standard Towers in distance.

single wheel driving a single alternator connected to a single three-phase transformer feeding a single transmission line which supplies energy to a single step-down transformer at the other end.

As illustrating the quality of the design it may be stated that in November this line was thoroughly tested out and was immediately put into operation with a load of 10,000 kw. and that although the weather conditions since that time have been extremely severe, due to high winds, rain, etc.,



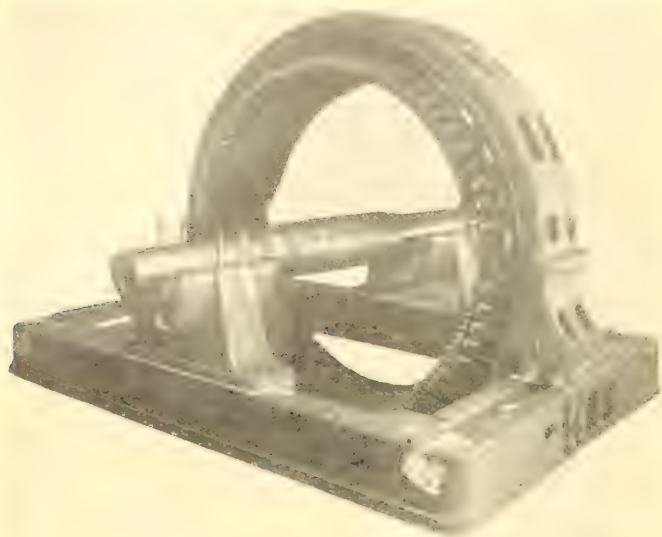
High Tension Transmission Entrance at Montreal.



High Tension Insulation and Switches—Montreal

there has not been the slightest evidence of weakness in the design of the transmission line.

The Montreal sub-station is finished and the first transformer unit of 12,500 kv.a. capacity, C. G. E. manufacture, stepping down to 12,500 volts, is now in operation. With this transformer are the usual high tension and low tension oil-switches. These are Canadian Westinghouse type. The



14,000 kv. a. 2-Bearing Westinghouse Waterwheel Generator.

underground cable system of the Montreal Light, Heat & Power Company receives the current direct from this sub-station at 12,500 volts.

Everything about the construction of this new plant, both at Shawinigan Falls and Montreal, represents the highest type of design and workmanship and the company has taken unusual precautions in increasing the factor of safety, with a view to preventing interruptions or troubles with the service. It is claimed that in many respects the new transmission line is the most substantial line of the kind that has ever been built.

The work of installation has been carried on under the direct supervision of Mr. Julian C. Smith, chief electrical engineer for the Shawinigan Water & Power Company.

Discussion on the Relative Merits of Open vs. Partially Closed Slots in Motor Design

By J. E. Dalemont, E.E., Agr. Sc., M. Sc.

The polyphase induction motor is still increasing in popularity and is used under widely varying requirements. With a squirrel cage rotor it is the most rugged and compact form of motor and has been successfully applied in this country even for large units. The effect of high starting current, an objection sometimes raised, is not an important factor with large distribution systems developed in the last few years.

Considering the selection of an induction motor from the purchasers view point, I may say that the manufacturing companies need experience no difficulty in adapting their design to the service to be rendered and in meeting, at the same time, the guarantees specified by the buyer. On the other hand, the designer has a wide field to draw from in fulfilling the specifications, and his choice must be influenced by the consideration of the manufacturing cost. One might fitly compare this problem with the solving of equations containing more unknown quantities than the number of given equations. Consequently the individuality of the designer enters into the problem, for he will only

find quickly the proper solution if he has enough technical knowledge and experience.

The requirements of the specifications extend usually over electrical as well as mechanical data, viz., power factor, efficiency, torque, slip, temperature rise, etc. There is a recent tendency to specify that the stator must be designed with open slots. This requirement has resulted from the increasing application of higher voltages even for small motors and also from the general opinion that, with open slots, damaged coils can be easily replaced if a break-down occurs. In addition the winding of a primary with open slots is considered to be cheaper in manufacturing than the winding of a motor with partially closed slots.

This is right to a certain extent. The writer, however, has reached the conclusion that in a great number of cases the motor with partially closed slots should be preferred to the open slot motor. In order to illustrate this conclusion it is necessary to compare carefully the advantages of either type.

To begin with, there are many cases where a partially closed slot motor can be designed and built in such a way that repairs can be made more easily than on the open slot motor. Moreover, to build an open slot motor having the same power factor, efficiency, torque, temperature rise, etc., as can be obtained with partially closed slots, we have to put more copper and iron in the machine. The result is that the open slot motor will always be much heavier than the other and this should be taken into consideration, especially when the motor is to be bought from a very distant factory. Then, as to the manufacturing cost, the same considerations may be applied, as it does not hold good as a general rule that the winding with open slots is much cheaper than with partially closed slots.

In order to add a very apparent illustration to the above statements, the writer recently designed two motors which were built in the same frame, one with open slots,

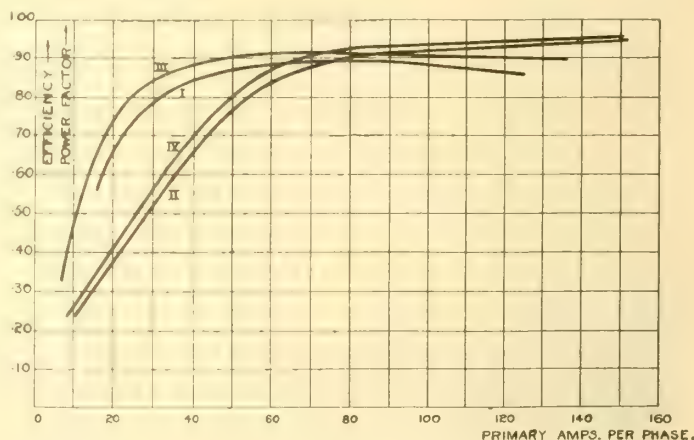


Fig. 1.

the other with partially closed slots. In Fig. 1, curves 1 and 2 show the efficiency and power factor as functions of the stator amperes, that is, for different loads, obtained with the 75 h.p., 3-phase, 25 cycles, open slot motor. Curves 3 and 4 show the efficiency and power factor for the same motor with partially closed slots, the number of closed slots, too, being exactly one-half of the number of open slots. If we assume that both motors run 300 days a year and 12 hours a day with successive average constant loads of $\frac{1}{4}$, $\frac{1}{2}$, full load and $1\frac{1}{4}$ load and if we figure at the rate of 85c. per kw.h. as the cost of energy, we obtain in Fig. 2: Curve 1.—Annual cost of power for motor with open slots. Curve 2.—Annual cost of power for motor with partially closed slots. Curve 3.—Annual saving of expenses using partially closed slots motor.

If the price of a 75 h.p. motor with open slots is estimated at \$900, and the price of a partially closed slots 75 h.p. motor at \$1,170, that is, thirty per cent. higher than the first

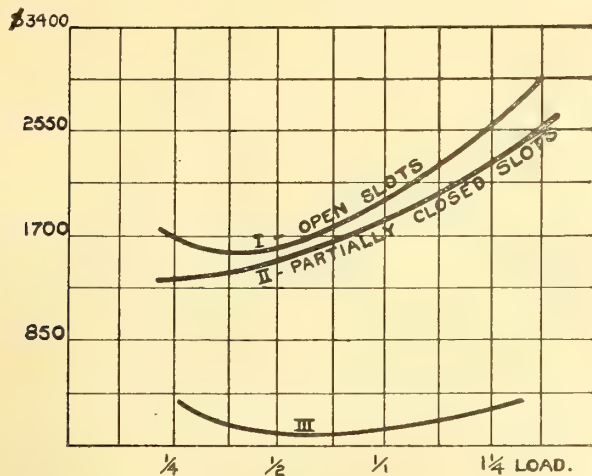


Fig. 2.

one, the total expenses after five years' operation, including cost of motors, are as follows, under the same assumption as above:

Average constant load	Open slots	Part closed slots	Net savings in favor of part closed slots
$\frac{1}{4}$	\$9,400	\$7,970	\$1,430
$\frac{1}{2}$	8,980	8,620	360
1	11,100	10,420	680
$1\frac{1}{4}$	13,900	12,470	1,430

In my opinion, it would be possible to consider less than thirty per cent. as the increase in the cost of motor due to the slots being partially closed and in some cases the price for both motors might be practically the same. Moreover, the differences shown in the above table would have been found greater if we had compared two motors with smaller rating.

Electrical vs. Manual Handling of Freight— Large Saving in Time and Money— Results of Actual Experience

By C. S. Mallett, A.M.I.E.E.

At the Hull terminal of the Hull & Barnsley Railway in England, the handling of freight arriving from the continent of Europe, a few years ago became a very serious problem. Extra room was provided on several occasions and more tracks were laid. Hand labor was employed exclusively for sorting, loading and unloading, and several hand operated jib cranes were occasionally brought into use. Unloading of carts at various points along the receiving platform was only adding to the condition of chaos, and the time taken to unload a cart was considerable, and was done slowly and laboriously.

After some hesitation and discussion the suggestion of electrically equipping the cranes was put into effect. Much scepticism prevailed, however, as to the result of such expenditure, but after the eight cranes were equipped it was immediately found that the cars could not now be placed before the cranes fast enough and a great deal of time was lost in this way.

To lessen fire risks it had been a rigid rule of the company that no locomotive could enter the freight shed. This meant that cars could only be placed at the cranes by use of a long train. As they had now four cranes electrically operated, on either side of the shed two locomotives were often required to attend to the shunt-

ing. Other conditions arose causing delay in placing cars, these not having been felt when the slower methods obtained. This discrepancy now became so marked that the work of placing cars by locomotives in the shed was discontinued in favor of electrically operated capstans, and with a liberal number of fairleads or idlers placed about, together with several transfer tables.

By the use of this equipment a couple of men at each end of the shed were sufficient to place the cars exactly as required, and in infinitely less time. The total result has been most satisfactory, and though it is but five years ago since the installation of the first electrically operated crane for this company, the present equipment amounts to sixteen jib cranes, fifteen capstans and one overhead travelling crane.

The specifications of the jib cranes are briefly, as follows: Lifting capacity, 3,360 lbs.; hoisting speed with full load, 40 ft. per minute; slewing speed, two revolutions per minute; radius of jib arm, 15 ft. All motors same horsepower and speed, 5 B.h.p. at 600 r.p.m. Current supply is taken from the mains of the local municipal electric lighting department.

After the plant had been in operation for some five months the engineering department took a record of the work done on four consecutive days, under ordinary working conditions, with the following results:

Total number of lifts made by eight cranes—1378.

Total weight lifted—638,400 lbs.

Average height of lift—4 feet.

Total number of loaded cars handled by capstans—1253.

Total empty cars so handled—1097.

Total current consumed on the cranes and capstans, 76.1 B.t.u., an average of 19 B.t.u. per day.

Aggregate h.p. of motors on cranes and capstans 120.

The cars were moved an average distance each of 36 ft.

Time taken to transfer a car from one track to another, 45 seconds.

Another instance where the experience was somewhat similar, was that of the North Staffordshire Railway Company at Hanley Station, when two whip cranes, worked by hand, were placed by two electrically operated jib cranes of 3360 lbs. lifting capacity, but in this instance the slewing of the crane was done by hand. One crane made 1,502 lifts in six consecutive days, representing a total weight of 901,376 lbs., for an expenditure of current of 50 B.t.u.

From the above figures taken under working conditions in railway freight sheds, we believe it a justifiable statement, that owing to the great gain in time and labor, and many other minor advantages, such an installation would more than pay for its first cost inside of six months, and especially so since neither the cranes nor capstans referred to were worked within 50 per cent. of their capacity. There is not the slightest doubt that cranes and capstans suitably arranged in a freight shed constitute an ideal arrangement for minimizing labor and expense in operation.

A Nova Scotia Merger

A merger has been completed between the company that controls the water power on the Mersey River and the company on the Gaspereau River. Both companies have charters from the Nova Scotia Government. The people directly interested in the merger are said to be Sir Frederick Borden; R. A. Robert and J. W. McConnell, Montreal; Hon. B. F. Pearson, F. B. McCurdy, M.P.; John R. MacLeod, Halifax, and Frank Stanfield, M.L.A., Truro. The merger includes the taking over of the Halifax Pulp and Paper Mills on the Mersey River. The company proposes to transmit power for lighting and power purposes to Halifax and the western half of the province.

Electric Drive in a Modern Flour Mill—Minimizes the Fire Hazard—Increases the Capacity—Applicable to All Work

In the milling industry, central electric stations should find a profitable market for the sale of power. Most modern flour mills are laid out for electric drive and the older mills, driven by uneconomical steam plants, will find it advantageous to substitute electric power. The modern mill is built generally of concrete, and every care is taken to avoid the danger of fire. Nevertheless, owing to the nature of the industry itself and to the construction of the milling machinery, this danger cannot be totally eliminated. It lurks everywhere in the old style mill, built of wood and driven by steam.

The Millers' National Insurance Company of the United States not long ago investigated fires in 482 mills, of which



20 h.p. Motor, Elevator Head Floor, Maple Leaf Milling Company, Port Colborne

one-half were totally destroyed, during the ten year period from 1897 to 1907. The records show that the kind of power used was distributed as follows:—

	Per Cent.
1 Water and gas . . . . .	.21
1 Steam and electric . . . . .	.21
2 Steam and gas . . . . .	.41
3 Gas . . . . .	.62
4 Electric . . . . .	.82
30 Water and steam	6.22
79 Water	16.39
362 Steam	75.12

482 Mills. 100.00

The evidence as to the causes of these fires is not conclusive because in 210 cases, or 43.57 per cent. of the whole, they are stated to be unknown. It is reasonable, however, to suspect some connection with the steam plant, since, in three-quarters of the fires, the mills were driven by steam power. Flour and wheat dust aid in clogging the shafting and in heating the bearings. Except for this trouble the dust is comparatively harmless when it is in a settled state. But when mixed with air in the proper proportion it becomes highly explosive. Every effort is therefore made to collect and dispose of the dust from the cleaning and milling machinery. It is good practice to endeavor to avoid

trouble by reducing contributory causes. The careful miller welcomes the substitution of direct individual motor drive for the interminable shafts and belts necessary with steam drive. The most striking results are greater economy in production and less danger of fire and, consequently, lower insurance rates.

A notable instance of the advantages of electric drive is afforded by the new mill of the Maple Leaf Milling Company, at Port Colborne. The present milling capacity is 4,000 barrels of flour daily, or about twenty-five car loads, but provision is made in the building to duplicate the plant and bring the daily capacity up to 9,000 barrels. The mill building and elevator are 600 feet long, 60 feet wide and 125 feet high, built entirely of steel reinforced concrete. The elevator consists of sixty bins, with a capacity of 1,000,000 bushels. Power is received from Decew Falls and brought in over the company's private transmission line. The sub-station is an isolated brick and concrete building and contains the transformers, switches, and other apparatus. Power is received at 20,000 volts, three-phase, 66 2/3 cycles, and is stepped down to 575 volts by a bank of three 800 kw. 20,000-575 volts, single phase, water cooled transformers, connected in delta on both high and low voltage sides. These transformers are provided with taps, so that with a primary voltage anywhere between 23,000 and 16,000 normal secondary voltage of 575 can be maintained at the switchboard. A small centrifugal pump driven by a 1 h.p. motor is provided to supply cooling water for the three transformers.

The following induction motors, 550 volts, 3-phase, 66 2/3 cycles, have been installed for the purposes set forth in the



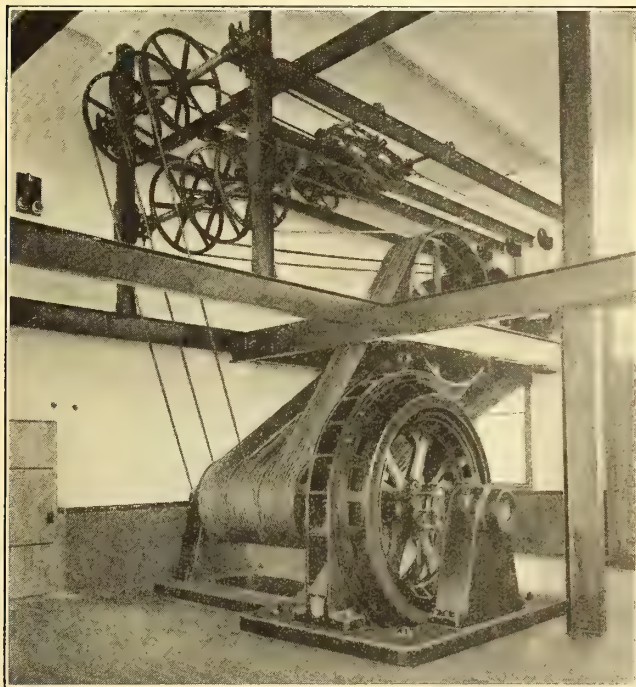
300 h.p. Motor, Wheat Cleaning Department.

following data. "F" means wound-rotor motor; "AN" squirrel-cage motor.

Type	No.	H.P.	R.P.M.	Work
F	1	700	500	Main Drive.
F	1	300	500	Wheat Cleaning.
AN	1	75	666	Packing House.
F	1	50	1000	Car Pull.
AN	1	20	1000	Humphrey and Freight Elevator.
AN	1	20	1333	Transfer Table.
AN	1	15	1333	Transfer Table.
AN	10	10	1333	Conveyors.
AN	1	10	1870	2-in., 2 S. Turbine Pump 100 U. S. Gals. 132 feet.
AN	3	7 1/2	1333	Conveyors.
AN	1	5	1333	Conveyors.
AN	1	1	1200	Volute Pump 10 Imp. Gals. 25 ft.

On the upper floor of the office building is an electrically equipped experimental bakery in charge of Mr. Benhur Kepner, B.A., M.S.Chem., where flour is received daily from all the company's mills and baking tests are constantly made to ensure conformity with the high standard set for its products.

The new mill was formally opened on November 18th, 1911, in the presence of 600 guests from various points. In less than three hours after placing the wheat on the mill the flour was up to grade and ready for market. The flour



700 h.p. Motor, Main Drive, Maple Leaf Milling Company, Port Colborne

mill machinery was built by Allis-Chalmers Company, in Milwaukee, and the electrical equipment by Allis-Chalmers-Bullock, Limited, in Montreal. In this way flour mill customers enjoy the advantage of dealing with only one firm for the entire equipment and avoid all the troubles which arise when responsibility for successful operation is divided between several companies. The contractor for the buildings was J. H. Tromanhauser, of Toronto. The officials of the company are Hon. D. C. Cameron, president; Cawthra Mulock, vice-president; Hedley Shaw, managing director; J. S. Barker, mechanical superintendent.

November Meeting Toronto Section A. I. E. E. —A Paper on one of the Most Extensive Power Systems in the World

The November meeting of the Toronto Section of the A. I. E. E. enjoyed a visit from the assistant chief engineer of the Southern Power Company, Mr. J. W. Fraser, who described in detail the equipment and operating experience on this very large system. Mr. Fraser's mission in Canada at that time was to present this paper before the electrical section of the Canadian Institute of Civil Engineers, and Toronto was fortunate in catching him on his return trip. The meeting was presided over by Mr. A. L. Mudge, who in introducing the speaker of the evening reviewed the situation in Canada in part as follows:—

Montreal has long enjoyed the reputation of being the most important focusing point in the world for incoming hydro-electric power, Niagara Falls the greatest centre from which hydro-electric power radiates. Both of these reputations will probably be maintained for many years to

come. Toronto, while unable to boast such high distinctions, can lay claim to being the centre around which clusters a most interesting group of high voltage power transmission systems, which cover the ground from which the Toronto Section of the American Institute of Electrical Engineers draws its membership. I wish to review very briefly the problems that have confronted the engineers who have had charge of the design and construction, and give you a few facts regarding these systems.

The first, although not the earliest in its inception, is that of the Toronto Power Company, with its power house at Niagara Falls, its transmission line to Toronto, where power is distributed for lighting, power and railway service. This company has one power house, 160 miles of 60,000 volt transmission circuit, two transformer stations and a peak load of 47,000 h.p. The transmission problem involved, except for the high voltage employed, was fairly simple, that of generating all the power required at one power house and transmitting it to one definite objective point in the vicinity of which it was to be utilized.

The second system is that of the Hamilton Cataract Power, Light & Traction Company. It has one power house, 125 miles of 44,000 volt transmission line, nine 44,000 volt sub-stations and a peak load of 32,000 h.p., to say nothing of additional lower voltage lines and sub-stations. The problem that confronted this company, although much the same at first as that of the Toronto Power Company, has become much more complicated by reason of its having developed steadily a network of lines to a number of sub-stations, and it has been a most interesting development from the 2,000 kw., 33 mile, 22,000 volt transmission which thirteen years ago established a notable record.

The third system is that of the Hydro-electric Power Commission of Ontario, covering a large district west of Toronto with its 375 miles of 110,000 volt transmission circuit, twelve sub-stations and a peak load of about 17,000 h.p. The most serious engineering problems involved in the design of this system were due to the extremely high voltage adopted, and to the requirement that it should be capable of very wide extensions beyond the limits of the initial installation.

The fourth system is that of The Electric Power Company, covering part of that section of Ontario which lies east of Toronto, with its five water-power stations, 220 miles of 44,000 volt transmission circuit and seventeen 44,000 volt sub-stations now in operation, with a peak load of 9,000 h.p. The problems in connection with this transmission system were different in some respects from those involved in the other systems mentioned, in that the power is generated at many widely separated points and transmitted to many widely separated sub-stations. Fortunately there was not the added difficulty of having to go beyond the well tried voltage of 44,000 volts, for which transmission apparatus has been fairly well standardized.

Now, gentlemen, we pride ourselves on these things, on the design, construction and operation of four important hydro-electric power transmission systems, and just when we think we are doing such a lot of fine work, along comes Mr. Fraser, of the Southern Power Company, to tell us of a system that is larger than all our four systems rolled into one, and combines all our problems and a few more. The Southern Power Company has more than twice as many miles of 110,000 volt transmission circuit as the Hydro-electric Power Commission, more miles of 44,000 volt transmission circuit than the combined mileage of 60,000 and 44,000 volt circuit of the Toronto Power Company, the Hamilton Cataract Power, Light & Traction Company and the Electric Power Company. It has a larger number of sub-stations of 44,000 volts and over, than all four systems, and it has a daily peak load which exceeds the combined peaks of all four systems. Mr. Fraser is the man

who, during the past seven years, has borne the brunt of most of the electrical work, to say nothing of certain activities with regard to the hydraulic and steam details of this great system."

The Southern Power Company

Mr. Fraser reviewed first the history of high voltage electric transmission in North America. His company was organized in 1905, at which time one of the foremost engineers of the day voiced the opinion that 30,000 volts was preferable to 50,000 volts. The first electric transmission in America was installed at Telluride, Cal., in 1890, where a 100 h.p. single-phase generator supplied power at 3,000 volts over a two-mile transmission line. In 1893 the first polyphase transmission was put into service in Redlands, Cal.; this was 3-phase, 2,500 volts, eight miles in length. In the same year it was decided to install polyphase generators at Niagara Falls. In 1895 a polyphase transmission at 10,000 volts was put into operation by the Folsom-Sacramento plant in California. In Canada the first polyphase transmission seems to have been at St. Hyacinthe, Que., in 1894.

During the next few years more rapid progress is noted. The Missouri River power plant was the first operating commercially at 50,000 volts, and the Shawinigan transmission to Montreal followed a few months later. In 1907 the Southern Power Company had 200 miles of 50,000 volt line and by 1909 twice as much. In that same year a 100,000 volt line of 250 miles was put in service and since that time the length of line has been largely increased.

A greater part of the power generated by Mr. Fraser's company is used by cotton mills of various sizes to the number of 156, the remaining power supplying six street car systems and the lighting and power load of forty-five towns and villages.

In describing the 100,000 volt lines the tower design was taken up in some detail. The specifications of the towers were quoted as follows:

1st. Wind strain of 6,000 lbs. at right angles to the line and simultaneous conductor strain of 2,500 lbs. on any two cross arms.

2nd. A vertical load of 1,200 lbs. on the end of any cross arm.

3rd. A load of 1,500 lbs. in any direction on ground wire support.

The weight of suspension tower is 3,600 lbs. Concrete anchors are not used on towers except in special cases when the soil is not firm or when large angles are to be turned. The suspension insulators have a diameter of 14 inches for the outer shell and 7 inches for the inner shell. Hooks and eyes are used for connecting insulators together, these withstanding readily a 10,000 lb. tension. Four such insulators are used on suspension towers and five on strain towers.

The sub-stations and switching arrangements of the system were described at length. It is of interest to note Mr. Fraser's remarks with reference to outdoor sub-stations. Outdoor sub-stations stepping down from 13,000 volts to 2,300 or 575 are installed at the mills. This type of sub-station has been very satisfactory, being reliable, cheap, quickly installed and easily changed or enlarged.

For the most part steel towers are favored on this system, though for the earlier lines cypress poles were used. These were not found to have a greater life than five years. Chestnut and juniper have a life of seven or eight years. Referring to the cost of such a line the speaker said that a 50,000 volt wood pole line using No. 00 B. & S. copper can be constructed in that district for approximately \$2,000 per mile. A steel tower line with the same insulators can be built for less than fifty per cent. additional, and a double circuit steel tower line can be built at approximately the same cost as two single pole lines. It follows that it

would be more economical to build steel tower lines than pole lines where the line is to remain unchanged for 15 or 20 years.

The speaker referred to the general policy to be followed in insulating a line. He expressed the opinion that it is much better to increase the line insulation so as to centralize the troubles which occur at the stations, where the trouble can be quickly inspected. Further, it is much easier to make provision for taking abnormal voltages off the line at a few stations than on hundreds of miles of line. His experience showed that there was very much less trouble on the 100,000 volt lines than on the 50,000 volt lines.

Some very interesting and helpful figures were given on the various items which go to make up the cost of a 100,000 volt tower line. The figures refer to No. 00 copper conductor, spacing nine towers to a mile, including one strain tower, and are as follows:

Towers	27%
Insulators	8%
Clamps	1%
Ground wire	2%
Conductor (6 No. 00 copper)	42%
Labor	15%
Interest during construction	3%
Engineering, supervision, and surveying, general office expenses	2%
	<hr/> 100%

Right of way not included.

It will be noted that by far the largest item is for conductors, and that insulation is comparatively a small factor. It was emphasized here that a small additional percentage cost of tower in comparison with the total cost of the line would add greatly to the factor of safety of the line.

The following classification of the item of labor was also given as typical in Mr. Fraser's district:

Digging holes	23%
Hauling and distributing towers	9%
Assembling	8%
Erecting	14%
Filling in holes	7%
Hauling and distributing insulators	8%
Hauling and distributing wire	6%
Stringing six conductors and one ground wire	25%
	<hr/> 100%

Mr. Fraser a Canadian

Mr. J. W. Fraser was born in Bridgeville, Nova Scotia, on March 6, 1874. He was educated in the common schools, in the high school of New Glasgow and in Pictou Academy. In 1895 he entered McGill University, Montreal, from which he was graduated in 1899 with the degree of "Bachelor of Applied Science." Two years later he received the degree of "Master of Science," in recognition of his experimental work on the distribution of alternating currents in a copper conductor. During his post-graduate course Mr. Fraser acted as Assistant in Physics the first year, and as Assistant in Electrical Engineering the second year.

After leaving college Mr. Fraser entered the shops of the Westinghouse Electric and Manufacturing Company, where he spent a little more than a year in the various manufacturing and testing departments and was later transferred to the erecting department. Shortly afterwards he accepted a position with the Shawinigan Water & Power Company, of Montreal, which company at that time was building the first 50,000 volt line to be put into service in Canada, and the second in the world—the first being that of the Missouri River Power Company, which antedated it by

a few months. As engineer-in-charge of construction, his connection with this pioneer work gave him an opportunity of assisting in the development of high tension transmission in its earliest stage, which was to prove valuable to him in his later and larger work. While in the employ of this company he also made an investigation of the use of telephone lines on the same poles with high tension transmission conductors.

In the autumn of 1905, when the Shawinigan line was completed and in successful operation, he returned to the Westinghouse company as constructing engineer. He was shortly sent south to take charge of the erection of power plants and large motor installations, principally in textile mills. His work there took him from North Carolina to Alabama, giving him a varied experience in the costs of construction, the managing of labor, and economy of design.

At about this time the Southern Power Company was being organized to take over the Catawba Power Company in South Carolina, whose plant was near Rock Hill, and to develop all the water power on the Catawba River. Mr. Fraser, on account of his experience, was selected as assistant chief engineer in charge of all electrical design and construction. He has since filled the position in its broadest



Mr. J. W. Fraser

sense, in that he is entrusted with the design and supervision of construction and is identified with the purchasing of all apparatus and construction material for this system. This new company was organized in the spring of 1905 and immediately proceeded to develop more power and to extend its radius of action. Within five years, three additional hydro-electric generating plants aggregating 66,000 kw., and several hundred miles of transmission line were built. By the autumn of 1908 all the territory that could be economically reached by 50,000 volts was covered and it was necessary to plan a 100,000 volt system. It may be noted that the development of the distributing system to take care of the output of these four generating plants, built at intervals, with no definite information as to future requirements, presented large problems to the designing engineer, particularly as this system covers a vast area, enters fifty-two towns and cities in which there are seventy-five sub-stations and is made up of nearly 1,400 miles of 11,000, 50,000 and 100,000 volt transmission line. Within the last year, there has also been added to the system, and constructed by Mr. Fraser, two 8,000 kv.a. auxiliary steam turbine generating stations, both of which are now in operation.

The territory covered is so large, the points of distribu-

tion so numerous, the generating plants so far apart, the variation of day and night loads so great, and the ultimate requirements at the numerous distributing points so hard to even approximate, that the provisions for regulation, switching, transfer of power, etc., involved a vast amount of detail and foresight on the part of the designer. That this enormous distributing system has been woven together into a successful operating machine in six years reflects great credit on the ability of this young Canadian engineer. To him must justly be accorded the honor of being a pioneer in 100,000 volt transmission, for, although one short line was in operation when the Southern Power Company's lines were designed, it remained for him to put into service a system that could be controlled with the same ease as a low voltage system and to put into service outdoor types of circuit breakers and sub-stations. He has always been an ardent advocate of outdoor types of circuit breakers and sub-stations; of ground wires as protection against lightning; of earth foundation for towers as opposed to concrete; of large line insulation, so as to localize trouble in the stations, and his judgment has always been amply vindicated by the successful operation of this system.

Mr. Fraser has been an occasional contributor to the technical press. In 1907 he wrote an article on "Southern Water Powers," for the *Electrical Review*, and since that time has contributed to the *Electrical World* and *Electric Review* and *Western Electrician*, descriptions of the various plants of the Southern Power Company as they were completed. He had a paper before the annual convention of the A. I. E. E. in 1908, entitled "Some Engineering Features of the Southern Power Company's System," and has contributed several discussions. He became an associate member of the A. I. E. E. in 1899 and a member in 1907.

Ottawa Notes

The Ottawa Car Company has installed a 500 h.p., 2,200 volt, 2-phase, 60 cycle, Canadian Westinghouse motor, direct-connected to a 450 kw., 500-volt, direct current Canadian Westinghouse generator, to supply current to the many direct current motors scattered throughout its shops, which are being extensively added to, to handle its rapidly increasing business.

The underground conduits and manholes for the Ottawa Electric Company's trunk line from the power house at the Chaudiere to the Slater street sub-station have been completed, and the work of pulling through the big 12,000-volt feeder cables is now about to proceed. Considerable work has also been done on the out-going underground circuit feeders from the sub-station.

The Ottawa Electric Light Company employees have formed a company section of the Canadian Electrical Association, now in affiliation with the National Electric Light Association. The organization meeting was called by Mr. A. A. Dion, general superintendent of the company, who is also president of the Canadian Electrical Association. The initial membership numbered over seventy-five and considerable additions have been made since. Mr. Dion was unanimously chosen as Honorary president and Mr. C. G. Keys as president. At the first regular meeting Mr. John Murphy, electrical engineer for the Railway and Canals Department in the Dominion Government, gave a reminiscent address, in which he recounted his early experiences as an employee of the Ottawa Electric Company. This drew forth similar stories from a number of the older men present which were very interesting and instructive. Mr. Murphy has promised a paper on some technical subject later in the year. The meetings will be held in a club room which has been generously fitted up for the purpose by the Ottawa Electric Company.

The Tremendous Water Powers of Canada

Report by Conservation Commission—Data Given on over 21,000,000 h.p. Large Areas Still Unexplored—Less than 5 per cent. Developed

The recent report of the Commission of Conservation of Canada on the water-powers of the various provinces of the Dominion is the most comprehensive statement of Canada's magnificent water falls that has yet been published. While it is true that much of the information contained is not new, still there is very much that is published for the first time, and the compilation of the old information with the new makes an exceedingly interesting and valuable compendium of information for the electrical engineer.

The work is largely the result of the investigations of Mr. Leo G. Denis, B.Sc., the hydro-electric engineer of the Commission of Conservation, and of Mr. Arthur V. White, C.E. During the last couple of years these engineers have spent much of their time in gathering information at first hand. It is pointed out that the data in connection with the Northwest Territories and the Yukon are still very uncertain, so that practically nothing is reported about them. Even in the Prairie Provinces in many cases the information has not been sufficiently accurate to record.

In addition to a classification of the water-powers the condition of water-power legislation in each of the provinces is carefully outlined. Ontario's Hydro-electric Power Commission, with the circumstances leading up to its formation, and its accomplished results is fully described. Similar information as far as it exists is given for the other provinces. It is pointed out that accurate information on any water-power is a matter of opinion and development. An accurate estimate can scarcely be made unless one knows the conditions of storage, etc., under which the development will be accomplished. For this reason the engineers wish it to be understood that the figures contained in their estimates do not represent in the majority of cases the amount of power that might be developed but rather the minimum of power in sight with a minimum expenditure on development equipment. The total amount of power classified in all of the provinces together, either developed or developable, amounts to 21,070,470 h.p. This includes nothing for the Yukon, and with the exception of one section nothing for the Northwest Territories. These matters are spoken of later under their various heads. The total amount of developed power is barely five per cent. of this, or 1,016,521 h.p.

Ontario

The water-powers of Ontario are divided into eleven districts which give a total of 6,760,595 h.p. This sum includes the power on the Ottawa River between Ontario and Quebec which is 838,200 h.p., according to the estimate. The districts with the quantity of power in each are given below. It is to be understood that the figures given represent a minimum of power.

District No. 1, St. Lawrence River and Tributaries.—Total power, 1,042,940 h.p. This is made up largely of three powers on the St. Lawrence River, the Galops, Cardinal and Iroquois Rapids 232,000 h.p., the Rapid Plat 178,000 h.p., and the Long Sault 618,000 h.p., the only other powers of importance being along the Lower Trent River, only two of which, Ranney Fall and Healey Fall, exceed 10,000 h.p.

District No. 2, Tributaries of Lake Ontario.—Total 101,685 h.p. This is made up of a number of small powers, the largest being that of the Peterborough Hydraulic Power Company, on the upper Trent River, of 3,200 h.p.

District No. 3, Niagara.—Total 1,508,835 h.p. This in-

cludes the estimated development of that part of the Niagara River belonging to Canada at and below the Horseshoe Falls, which is placed at 1,000,000 h.p. at the falls, and 450,000 h.p. below the falls. The De Cew Falls developed by the Hamilton Company, is also placed at 50,000 h.p.

District No. 4, Tributaries of Lake St. Clair and Lake Erie.—7,815 h.p. These, for the most part are developed and drive mills of one kind or another.

District No. 5, Tributaries of Lake Huron.—7,575 h.p. Included in this district are the Maitland River development, which is placed at 1,000 h.p., and the Saugeen Fall valued at 1,310 h.p.

District No. 6, Tributaries of Georgian Bay, northward to Muskoka River.—28,530 h.p. In this district are included Eugenia Fall, 1,090 h.p.; Big Chute placed at 3,350 h.p.; Ragged Rapids 2,020 h.p.

District No. 7, Tributaries of North Georgian Bay and Lake Superior.—Total 388,465 h.p. The largest item here is the St. Mary River Rapid, with an 18-foot fall estimated at 98,200 h.p. The Nipigon River supplies two falls of 19,000 h.p. and numerous smaller ones. The development of the Spanish River Pulp & Paper Company, at Espanola, with a 62-foot fall, is placed at 10,145 h.p.

District No. 8, Winnipeg and English Rivers and their tributaries.—203,840 h.p. The largest fall in this district is on the Winnipeg River at a point called Island Fall, where the power is estimated at 59,300 h.p.

District No. 9, James Bay slope.—The data published in this connection is taken largely from an estimate made by Mr. L. V. Rorke, Inspector of Surveys, Department of Lands, Forests and Mines, Ontario. Mr. Rorke's estimate was published in the Electrical News of July, 1910. It amounts to about 2,000,000 h.p., not taking into consideration 5,000 h.p. falls or less.

District No. 10, Tributaries of the Ottawa.—95,710 h.p. No very large individual falls are included here. The largest being High Falls on the Madawaska estimated at 5,960 h.p.

District No. 11, Ottawa River powers between the river mouth and Lake Temiskaming.—Total 1,375,000 h.p. This is made up chiefly of large power units including Carillon Rapids, estimated at 200,000 h.p., with a regulated flow, and Chats Falls placed at 150,000 h.p.

This brings the total for Ontario, including the Ottawa River, up to 6,760,595 h.p. Leaving out the Ottawa River the figure is 5,922,395 h.p. The amount developed is placed at 532,266 h.p., or about nine per cent. of the total.

Quebec

Less definite information is available on the Quebec water-powers than was obtainable for Ontario. The total for Quebec is 5,560,155 h.p., as given in the estimates, but many of the heads and the figures for the water-flow are little better than estimates, and the total is probably well above this amount. This, it will be seen, is slightly below Ontario, though only by a matter of about 300,000 h.p.

District No. 1, Tributaries of the Ottawa.—Total 433,690 h.p. This is made up of units up to 50,000 h.p., very few of which have been developed at all.

District No. 2, North Shore of St. Lawrence between the Ottawa and the St. Maurice.—21,830 h.p.

District No. 3, St. Maurice River Basin.—358,540 h.p. This includes the Shawinigan Falls, which is estimated at

130,000 h.p., the La Tuque 85,000 h.p., and two other 40,000 h.p. falls on the St. Maurice River.

District No. 4, North Shore of St. Lawrence between St. Maurice and Saguenay.—30,735 h.p.

District No. 5, Saguenay River Basin.—A total of 1,003,400 h.p., including a Saguenay development of 153,000 h.p., and another estimated at 375,000 h.p.; also a 100,000 estimate at Great Bear Fall on the Ashwamuchuan River.

District No. 6, North Shore of St. Lawrence below the Saguenay and the Hamilton River Basin.—1,241,300 h.p. This, for the most part, is only estimated. Much the largest falls are on the Hamilton River, three being named of 300,000, 120,000 and 86,000 h.p. respectively. It is mentioned that the largest of these powers would be extremely difficult to develop. The head in this latter case is mentioned as 760 feet. Another considerable fall in this district is on the Manikugan with 165 foot fall, calculated to develop 130,000 horse-power.

District No. 7, south shore of St. Lawrence below River Du Loup.—43,000 h.p.

District No. 8, south shore of the St. Lawrence between Du Loup and Chaudiere.—10,260 h.p.

District No. 9, south shore of St. Lawrence above Chaudiere, including St. Lawrence above Montreal.—1,446,400 h.p. This includes the Coteau, Cedar and Cascade Rapids, placed at 960,000 h.p., and the Lachine, placed at 400,000 horse-power.

District No. 10, James Bay Slope.—971,000 h.p., none of which is developed. In this list a number of rivers are not estimated. The total is made up of a number of considerable horse-power units many of them above 50,000 h.p., but only one of which exceeds 100,000 h.p.

Total for the province of Quebec, 5,560,155 h.p., with a number of large falls only estimated and several with no figures given on account of lack of definite information. The amount of developed power is placed at 300,153 h.p.

Nova Scotia

There are no large water-powers in Nova Scotia, and the total only reaches 83,200 h.p.; 15,272 h.p. developed. The province is divided into three districts.

District No. 1, Mainland east of Halifax, with a total of 19,230 h.p. This is made up of a large number of small powers under 1,000 h.p., only one estimate reaching that amount.

District No. 2 is the Mainland west of Halifax. This also is made up of a large number of small powers, though several exceed 1,000 h.p. The largest is Lake Fall on the Liverpool River, estimated at 4,200 h.p., with a 73-foot head.

District No. 3, is Cape Breton, with a total of 1,060 h.p.

New Brunswick

The total of power in New Brunswick is also not great. Some valuable hydraulic data relating to the rivers of New Brunswick have been collected and included in the report. The total of the water powers is 280,445 h.p.; 9,765 h.p. developed.

District No. 1, Southwestern New Brunswick.—46,505 h.p. This includes one 10,900 h.p. at Sprague Fall on the St. Croix River, with a 46-foot head.

District No. 2, Southeastern New Brunswick, only contains 1,150 h.p.

District No. 3, The Miramichi River and its tributaries.—Total 13,455 h.p., the largest of which is a 5,000 possible h.p. development at Grey Rapids.

District No. 4, Northern New Brunswick.—18,190 h.p. This includes one 6,500 h.p. fall.

District No. 5, The St. John River and its tributaries.—Total 201,125 h.p. This includes the large water-power at Grand Fall on the main river, estimated at 120,000 h.p., under a 125-foot head, two other powers on the St. John

River of 33,000 and 9,000 h.p., and 13,000 h.p. at Aroostook Falls on a river of the same name. This latter has been developed in part by the Maine and New Brunswick Electric Power Company, who export to the United States for operating their electric railway.

Manitoba

By far the largest water-powers of Manitoba are on the Winnipeg River. The total for the province is placed at 412,000 h.p., all of which, if we except about 3,500 h.p., is on the Winnipeg; 48,300 h.p. developed.

Saskatchewan

Only incomplete information could be obtained about this province. The total recorded power is 20,200 h.p., but this does not include the Black River, with its numerous falls, one of which is as high as 160 feet; 45 h.p. developed.

Alberta

Very little accurate information has yet been obtained on the water-powers of this province. The North Saskatchewan River at Rocky Rapids is credited with 35,000 h.p., but these figures are stated to be very approximate. The Peace River, the Athabaska River, with its numerous falls, the Sturgeon River, the Blindman River, with 30-foot head, the St. Mary River with 90-foot head, and the Gold Creek with 100-foot head, are not estimated. The total power credited to this province is 70,430 h.p.; 7,300 h.p. developed.

The Northwest Territories

Still less information is obtainable in the Northwest Territories. Only the Nelson and Saskatchewan Rivers have been estimated. It is stated that no reliable data are available respecting the numerous other powers, and nothing has been printed pending the collection of reliable information. The territories, however, are credited with the modest amount of 6,859,000 h.p., all, with the exception of 80,000 h.p., at Grand Rapids on the Saskatchewan River, being found on the Nelson River. Three falls on the Nelson give over 1,000,000 h.p. each; no power yet developed.

Yukon

No estimate whatever is made of the powers in this province. There is one small development of 20,000 h.p. by a mining company which they transmit thirty miles, but no data of the falls on the Yukon or the Mackenzie seems to be available.

British Columbia

In connection with this province it is stated that fully ninety-five per cent. of the powers are either unknown or have not been gauged. The total is placed at 1,024,445 as representing the minimum development of the known powers. If we are to understand that this represents only five per cent. of the water-powers of British Columbia the total power when complete surveys have been made will indeed be considerable. The province is divided into districts as follows:

District No. 1, Columbia River and Tributaries.—225,115 h.p. This includes the Pend d'Oreille, 65,000 h.p., and 45,000 h.p. falls; also the various powers in the Kootenay district.

District No. 2, Fraser River and Tributaries.—513,150 h.p. This includes the B. C. E. R. developments on the mainland, the Western Canada developments, three 50,000 h.p. falls that have not yet been touched, and 100,000 h.p. fall on the Thompson River.

District No. 3, Vancouver Island.—61,680 h.p. The Jordan River development of the B. C. E. R. Co. is included in this and their Goldstream development of 4,000 h.p.

District No. 4, Mainland Pacific Coast.—224,500 h.p. This includes a 100,000 h.p. fall on Powell River with a 140-foot head, also two other falls with 560 and 300 foot heads.

District No. 5, Northern and Northeastern water sheds. —Peace River is included in this district with 270-foot fall at one point, but no estimate whatever has been made of the power.

Altogether these water-powers total up to 21,070,470 h.p., and when it is considered that the figures given above represent the minimum in most cases, which may easily be doubled or trebled under proper conditions of control, and

when we consider that in British Columbia, Yukon and Northwest Territories, the James Bay Slope of Ontario and in Labrador estimates are either entirely lacking or are too meagre to have found a place in this report, we may well be satisfied that the ultimate development of Canada's water-powers will reach, to put it conservatively, two or three times this figure. A reasonable guess would lead one to expect that 50,000,000 h.p. will some day be available.

The Simcoe Railway & Power Company

Plant at Big Chute on Severn River Now in Operation
—Drainage Conditions Outlined—Capacity 7,000 h. p.

The Simcoe Railway and Power Company have recently placed their Big Chute generating station, on the Severn River, in commercial service to serve power to the counties of Simcoe and Muskoka, and particularly the towns of Midland, Penetanguishene, Victoria Harbor, Port McNicholl, Coldwater, Barrie and Orillia. The plant is particularly worthy of note as being the development of the largest hydraulic source of power in the Georgian Bay district and as it is destined to be the nucleus of a power system which will doubtless serve within a radius of seventy-five miles and which may combine the various future developments possible on the Severn River and other rivers flowing into the Georgian Bay.

Development was started in the fall of 1909 and in May of this year 4200 horse power was developed and commer-

velopment while next month's issue will contain a further article treating the hydraulic machinery, the electrical portion of the development and the transmission lines.

The general location of the Severn River waterway system is such as to drain all that portion of Central Ontario in the vicinity of Lake Simcoe and comprises a total watershed area, above the Big Chute, of about 2,250 square miles. This area is constituted as follows:

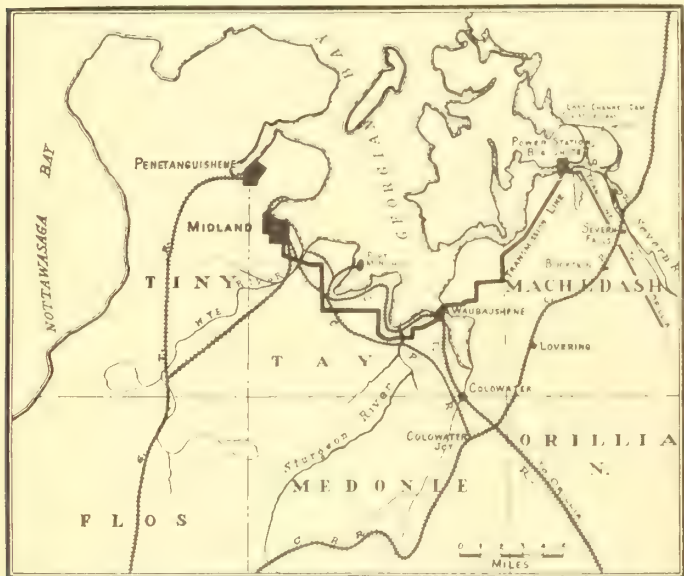
Land area, including small streams, 1800 sq. miles.

Water area: Lake Simcoe, 300 sq. miles; Lake Couchiching, 15 sq. miles; Sparrow Lake, 5 sq. miles; other various lakes and large rivers, 130 sq. miles.

The general nature of the country drained has two characteristics. The southerly portion of the area comprises rolling and flat country and the northerly portion, rough, rocky and hilly regions. At one time the area was wooded but recent lumbering operations have deforested the northerly portion very rapidly, only a portion at the extreme north-easterly end and isolated districts in the north-west still remaining. Probably seventy per cent. of the area may be generally termed settled, the southerly portion being fairly dense and the north, sparsely. Settlement, however, is proceeding in the north and the streams are consequently being improved and lands drained. Owing to the large proportion of lake area in the watershed the discharge of the Severn River is comparatively steady throughout most of the year, as the lakes act as regulating reservoirs.

Based on continual measurements during the last twelve years, the flow of the Severn above the Big Chute locality for practically the whole year will, it is estimated, not fall below 950 cubic feet per second excepting from the middle of January to the middle of March. Water control of the head lakes will effectually conserve the water supply and, deforestation having reached its limit, reforestation will gradually retard the run-off to benefit the continual flow.

Temperatures in this district run very low in the winter, short periods at 30 degrees below zero not being uncommon. The result of this is the formation of very thick sheet ice on the quiet waters of the river and of a certain amount of frazil ice in the falls and rapids as the broken water is exposed to the cold air. The Big Chute site is fortunately situated in this respect, as for a distance of ten miles above the chute the few very slight "swifts" are flooded out. At Ragged Rapids, ten miles above the Big Chute, the town of Orillia has developed power so that those rapids have been flooded and during the winter practically all the water is passed through their hydraulic system without coming in contact with the air. It is evident that there is practically no opportunity for the formation of anchor or frazil ice which would affect the Big Chute plant.

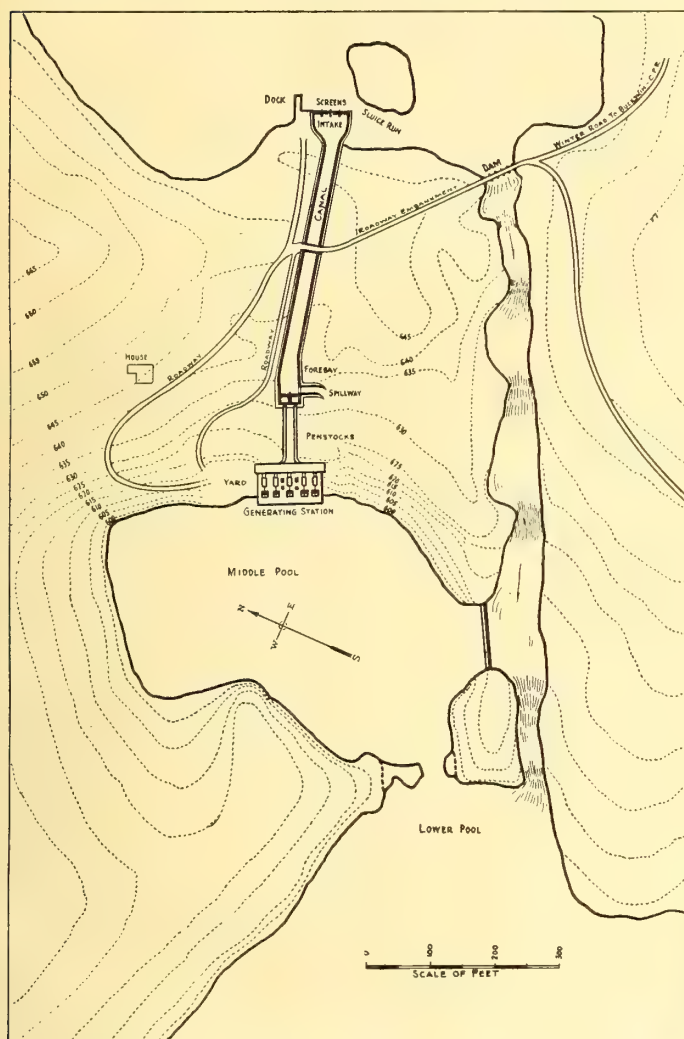


Big Chute Power District, Simcoe Railway & Power Co.

cially available in Midland. The power market will include the municipal and industrial operations in the towns in the vicinity and in addition the flour mills and immense grain elevators now constructed after the determination of the Canadian Pacific and Grand Trunk Railways to make the district the terminus of the lake carrying portion of the grain route from the West. The natural market possibilities are large and will doubtless soon necessitate the further extension of the Big Chute plant and the development of the Little Chute and the falls at Port Severn, in the near future: the latter sites are now held by the power company.

This article proposes to deal with the Severn River drainage system and the hydraulic portion of the Big Chute de-

The Severn River in the locality of the development has three points of discharge over the ridge forming the falls. These are Lost Channel, Six Mile Channel, and Big Chute; the former are distant $2\frac{1}{2}$ and 1 mile upstream from the Big Chute. The river at Big Chute makes a straight rapid series of falls through a narrow gorge for about 300 yards after which the stream divides, part going straight to the lower pool, the main part however passing to one



General plan of works at Big Chute, Severn River

side into a middle pool, thence out into the lower pool over a small cascade 2 feet in height. The total natural fall under normal conditions is 50 feet.

The general hydraulic portion of the development included the construction of dams, intake, canal, forebay, gates, spillway, penstocks, power station, hydraulic machinery and tail discharge, the whole providing for a development of 58 feet head.

The Big Chute dam is shown in the accompanying photograph and consists of massive piers and concrete sills with stop logs and spill crests. The piers are bridged over and form the roadway bridge for the winter road and for the road from a boat landing some two miles below to which the river is navigable from Port Severn on the Georgian Bay; the winter road is direct to Buckskin Station on the Toronto-Sudbury line of the Canadian Pacific Railway.

Lost Channel dam is located in a narrow gorge and consists of stop logs seated in shore piers. The Six Mile Channel dam is of similar construction to the Big Chute dam.

The water is carried through a canal from the upper level to the forebay at the brow of the rocky ridge above

the middle pool and from thence to the power house through steel penstocks and is discharged from the turbines into the middle pool underneath the power house and thence into the lower pool below the foot of the chute. The chute is dammed where dividing at the "Twin Falls" to compel the overflow water to go directly to the lower pool; the rocky ridge between the middle and lower pools has been removed and the difference in level gained for the lower head.

Reference may be made to the accompanying sketch showing the general layout of the works.

The canal entrance widens out to form an intake which is protected with four sets of racks supported by the concrete piers. The photograph of the intake shows the piers and framing for racks and further shows the canal in the background. Racks are of iron with wooden tops extending out of the water so that the frost from the air cannot be conducted to the iron portion in winter, thus preventing the freezing up of the openings between rack bars. The concrete is built up on the solid bed rock and continues along as lining for the canal to the forebay. Stop log seats are arranged at the entrance from intake to canal so that the head-water can be shut off entirely from the canal. A sluice run has been excavated alongside the intake in the river bed to take care of the ice and debris.

The canal is about 500 feet long and terminates in a forebay from which two steel penstocks, nine feet in diameter, lead down to the power house. The forebay is protected by a housing which will be heated in extreme weather; a curtain of 8 x 10 timber extends from the housing sills downwards into the water and both encloses the air space in the forebay and acts as an ice and trash boom in front of the racks. A spillway with adjustable stop-logs, forward of the curtain, regulates the water level and discharges debris; a small sluice-way is placed in front of the racks, in the housed portion, and carries out any debris caught by the racks. Both spillway and sluice discharge into a natural gully in the rock and flow down to the lower pool.



Generating Station at Big Chute, Severn River

The racks are of iron bars arranged for easy handling and raking. The penstock entrance has a large bell shaped mouth about 13 feet in diameter; stop logs with handling winches act as penstock gates.

Up to this point the development is for the ultimate output but at present but one of the penstocks is installed. The total machinery provided for will be 6800 h.p. of hydraulic turbines; at present 4200 of this is installed, in three main units and two excitors, leaving two main units to be installed later. The third power turbine will be fed ultimately from both penstocks with a Y connection and the exciter will be also arranged to connect to either source.

The penstock is carried on several concrete piers for

about 150 feet down the slope and turns along the rear of the power house, terminating in a surge tank extending to an elevation four feet above that maintained in the forebay. Nos. 1 and 2 turbines are connected with the pen-



Intake to Power Canal, unwatered—Severn River

stock by diverging feeders and No. 3, the centre unit, is connected by the present portion of the Y connection. No relief valves are installed on penstock or turbines, the



Diverting Dam at Big Chute, Severn River

surge tank being ample to take care of all pressure changes.

The further description of the equipment of power house, etc., will be presented in next month's issue.

Hamilton has Let Contracts

The city of Hamilton's hydro-electric department has awarded contracts for 400,000 duct feet of underground clay conduits to the Clermont Sewer Pipe Co., 50 Church street, New York. This company was represented when the tenders were opened, by Mr. B. S. Barnard its vice-president. It is possible that next year this underground work will be greatly extended by installing a general municipal conduit system and that all of the users of conduit will be required to use the municipal system and pay a rental to the city. This would eventually represent an installation of about 2,000,000 feet of conduit. It is said there are cities where a revenue ranging from 5 to 12.5 per cent. on the invested capital has been obtained in this way. Mr. Barnard states that his company has supplied conduit this year to the Bell Telephone Co., Montreal Light, Heat and Power Co., Cobalt Power Co., Spanish River Pulp and Paper Co., Northern Electric Co., and many propositions of less importance. The installation in Hamilton is in charge of Mr. E. I. Sifton who recently installed the London, Ontario, system.

Personal Mention

Mr. W. P. Roper is severing his connection with the Canadian General Electric Co., Ottawa, to enter business on his own account.

Mr. R. A. Brown has been appointed general superintendent of the electric light department at Calgary. Mr. Brown formerly held a similar position in Nelson.

Mr. J. H. Cornish, of the Toronto office of the Canadian General Electric Co., has been transferred to Ottawa as manager of that district for the same company.

Mr. Herbert E. Thomas, late manager of the Kenora public utilities, has been appointed superintendent of the electric light department in Nelson, succeeding Mr. R. A. Brown.

Mr. H. W. Price, B.A.Sc., associate professor of electrical engineering in the Applied Science Department of the University of Toronto, lectured before the Toronto section of the A. I. E. E. at their December meeting. Professor Price's subject was the oscillograph.

Mr. K. B. Thornton has been appointed chief engineer and operating manager of the Canadian Light & Power Company, Montreal. In order to accept this position, Mr. Thornton has resigned the post of chief engineer of the operating department of the J. G. White & Company, New York.

Mr. C. A. Howe, illuminating engineer of the Holo-plane Co., Ltd., of Toronto, has been delivering an interesting lecture in a number of towns throughout Ontario on the subject of proper illumination. Mr. Howe's efforts in the interests of a more scientific illumination are said to be meeting with much appreciation.

Mr. F. A. Yerbury is severing his connection with the Canadian Boving Company on January 1st and accepting an appointment with a new company in Vancouver, known as the Heaps Engineering Company, Limited, the president of which is Mr. E. H. Heaps, a gentleman well-known throughout British Columbia for his long connection with industrial concerns there. This company will install large rolling mills and probably the first electric steel making furnace in Canada of the well-known Gronwall type; have a shipbuilding plant and manufacture motors of the internal combustion type for marine and automobile purposes. They will also handle one or two good agencies, including the Commer cars and Simonis motor fire engines. Mr. Yerbury is well known throughout Canada in connection with the introduction of the Diesel oil engine.

New Companies

Winnipeg Electric Water Heating Company, Limited, Winnipeg, Man., incorporated with a capital of \$50,000. Incorporators, Geo. A. Glines, Victor George Williams, M.D., and Wm. E. Wright, all of Winnipeg.

Electrical Construction Company, Limited, Vancouver, B.C., incorporated with a capital of \$75,000 to buy, sell and deal in light, heat, power or other electrical machinery and supplies.

Fraser Lake Water & Power Company, Ltd., Victoria, B.C., incorporated with a capital of \$25,000, to construct and operate telephone and telegraph systems and carry on a general water power business.

Automatic Reversible Battery Boosters

An unusually comprehensive paper was recently read by Mr. R. Rankin, associate member, before the Institute of Electrical Engineers, on the subject of automatic reversible battery boosters. Mr. Rankin's paper is especially interesting at this time when the question of installing boosters is under consideration by so many Canadian engineers. A lengthy review of the article is given below.

Classification of Boosters

Broadly speaking, the boosters in use in this country belong to one of three classes:—

- (A) Those in which the booster can be self-contained and operated by its own field windings independently of any outside controller.
- (B) Those in which a so-called exciter is an absolute necessity, not merely for exciting purposes, but being an essential in the theory of the system.
- (C) Those in which an external automatic regulator is used on the booster field, either indirectly or through an exciter, the latter not being essential in the theory of the scheme.

Class A.

A number of boosters of the type A are minutely described and illustrated in the paper, but the "differential booster" has been taken as typical. Other boosters which get more or less space in the paper are the Pirani, Crompton, and Lancashire.

Differential Booster.—The simplest type in this class is the simple differentially wound machine shown in Fig. 1. In this case a coil A, carrying a portion of the total load

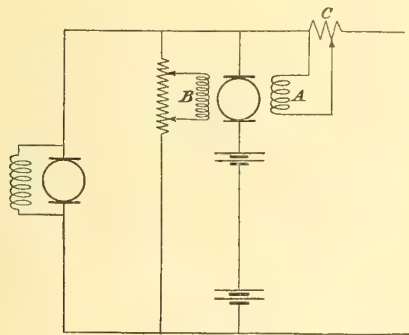


Fig. 2

current, and giving a booster voltage in the discharge direction, acts in opposition to a coil B, excited from the busbar voltage, and giving a field tending to produce a charge boost. The busbar voltage being assumed constant, the effect of coil B will be constant and definite for a definite adjustment of its regulator. The effect of coil A will just balance that of coil B when the line current has some definite value. The battery being assumed in a floating condition—that is, its voltage, with no current flowing into or out of it, being just equal to the busbar voltage—it is evident that the battery will be idle and the generator will supply the load when the effects of coils A and B just balance each other. An increase of load past the definite value required to make A balance B will cause A to overpower B, and a resultant booster voltage in the discharge direction will be produced. The battery will accordingly come to the assistance of the generating plant, and will give a discharge current of such a value that the total drop of voltage due to it, in the battery-booster portion of the plant, will just equal the voltage produced by the excess of the effect of A over

that of B. With ideal working and the diverter C properly proportioned, the discharge current would be practically equal to the excess of the current over that at which A and B were just balanced. A decrease in line current would have an exactly opposite effect, B overcoming A, and the battery charging by an amount practically equal to the drop in line current.

The battery being continually on the charge or discharge, its E.M.F. will not remain at the floating value, but will vary considerably, as also will its resistance. For this, in the scheme under consideration, there is no compensation, and although the line current has such a value that A just

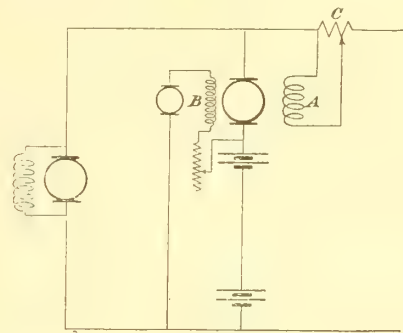


Fig. 1

balances B, the battery may be discharging or charging, depending on whether its voltage is above or below the floating value. Owing to the battery resistance being variable, with a low state of the battery the same charge and discharge will not be obtained with a given variation in line current, as was obtained when the battery was in a floating condition. A similar remark applies when the battery is in a higher state of charge than that represented by the floating condition.

This action renders it impossible to obtain good regulation of the load on the main generating plant, and various methods are employed for the purpose of compensating automatically for the varying state of the battery.

Class B.

Under this class also a number of boosters are described, of which the Highfield Diverter Booster only is given below. Another type similar to the Highfield and which receives a lengthy description in the paper is the E. C. C. booster.

Highfield Diverter Booster.—The connections of the Highfield booster are shown in Fig. 2. In this case the varying state of the battery is compensated for by the employment of a small exciter. This is connected in opposition to the battery through the booster shunt coil, so that the latter is excited by the difference between exciter and battery voltages. The coil is designed in the same way as the third coil used across the terminals of the booster in the Crompton and Lancashire schemes, and the field it produces is of such a value as would produce a booster voltage exactly equal to the voltage across the terminals of the coil—that is, the difference between exciter and battery voltages. The diverter coil circuit being assumed open there is, therefore, always a voltage in the battery-booster portion of the circuit equal to battery voltage plus or minus the difference between battery and exciter voltages—that is to say, a voltage equal to the exciter voltage. The state of the battery when in a normal stable working condition is therefore compensated for.

The facts that the exciter is a constant voltage machine, and that the booster shunt coil gives a booster voltage equal to the difference between battery and exciter voltages, make it possible, with a Highfield Booster, to run the battery and booster alone on the load, and yet have a constant line voltage automatically provided. The exciter voltage being made equal to the desired busbar pressure, current can be supplied to the load at normal steady voltage during the whole period of running with the generator shut down. Compounding over the steady value, if desired, can be obtained via the diverter. This is sometimes an advantage, and is one reason why a Highfield booster may be preferred to other boosters of the diverter type, although compounding via the diverter can be obtained with the others under similar circumstances.

With the circuit of the diverter coil closed there is the additional voltage effect of it to be considered, and this always tends to give a voltage in the discharge direction, since the direction of the line current is constant.

With a given value of exciter voltage, the battery and booster will just float on the busbars when the line current has such a value that exciter voltage plus diverter boost is exactly equal to busbar voltage. A rise of line current past this will cause an increase in diverter boost, which increase, with proper adjustment of diverter resistance, will just make up the drop of voltage in the battery-booster limb of the circuit when a discharge current is flowing approximately equal in value to the increase in line current. Similarly a decrease of line current will cause the diverter boost to decrease by an amount sufficient to allow a charging current to pass into the battery approximately equal to the fall in line current.

Class C.

The Entz booster is typical of class C and is described at length. The article also describes similar boosters, such as the B. T. H. booster, the Tilney booster, the Thury, the Brown-Boveri and so on.

In this class of booster, control is usually made to depend on small variations in the generator current which it is desired to regulate, these small variations being turned to account to prevent the occurrence of larger variations. The idea is somewhat akin to that employed in the hit-and-miss system of governing a gas engine. The regulation does not depend on exact design, but on the rapidity with which the regulator can act, and, as will be seen from the following discussion, arrangements can be made to ensure very rapid action indeed.

Entz Booster.—The simplest system is that invented by Entz, the prominent feature of which is a piece of apparatus called the Entz carbon regulator. The connections are as shown in Fig. 3, where an exciter is shown connected across the booster field, the field of the exciter being controlled by the carbon regulator. The latter consists of two sets of piles of carbon discs A and B, connected in series across a section of the battery; in the figure it is, for simplicity, shown across the whole battery. The junction of the two sets is connected, through the exciter field C, to the middle point of the section of the battery in use. The generator current which it is desired to regulate is carried round a solenoid D, provided with an iron core suspended from the end of a lever arranged with a pressure transmitter for each set of carbon piles. The pull on the solenoid core is opposed by a spring as indicated in the sketch. The sets of carbon piles being in series across a section of the battery, the potential differences across them will be directly proportional to their resistances, which are varied by the movement of the regulator lever. The potential of the middle point of the regulator, that is, the junction of the two sets of piles, relative to the potential of the middle point of the section of the battery in use,

will therefore obviously vary with the relative resistance of the two sets of piles and a current will flow through the exciter field when the resistances of the two sets are unequal, the direction of the current depending on which of the sets of piles has the greater resistance.

When the pull exerted on the core of the regulator solenoid is equal to the tension of the spring with the lever in the horizontal position, the resistances of the two halves of the regulator are equal. This will be the case when the line current has a certain definite value, and the battery, if in a floating condition, will then be idle. Should the line current increase the generator current will increase, but a small increase of solenoid current will disturb the balance

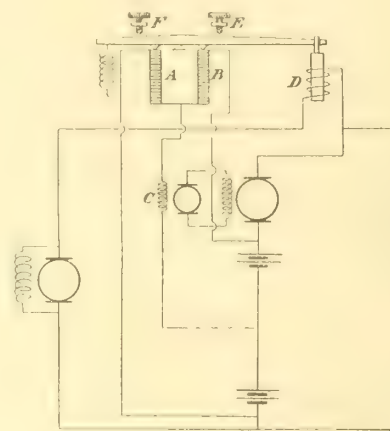


Fig. 3

between the pull on the core and the tension in the spring. Pressure will accordingly be put on the set of piles adjacent to the solenoid, with the result that a current will flow in the exciter field in such a direction as to give a discharge voltage on the booster. This, by drawing current from the battery, will prevent a further increase from getting back to the generator, and, although the regulator is designed to give, momentarily, a voltage for excitation purposes in excess of that actually required, overshooting of the correct discharge checks itself, because immediately the battery discharge begins to relieve the solenoid of the small increment of current, the pull on the solenoid core begins to fall, and consequently the pressure on the compressed set of carbon piles also falls, which pressure is directly responsible for the discharging voltage of the booster.

The effect of a fall line current is to enable the spring to pull the lever down on the other set of piles, and the direction of current in the exciter field is now such as to cause a charge boost. Should the battery not be in a floating condition the regulator will automatically exert a pressure on the proper set of piles, so as to keep the battery idle when it should be so. The overall effect is to give a practically steady generator current, the variations up and down from the mean value being small. Excellent results are being obtained with this system, generator current charts taken in traction stations dealing with very highly fluctuating loads having an appearance more like good voltage than current charts.

The travel of the lever, and hence the corresponding charge and discharge battery currents, can be limited by stops E and F placed above it. This allows the best possible regulation to be obtained so long as the line fluctuations are within the capacity of the battery and booster, and, when the fluctuations are excessive, they are thrown back on the main generator and advantage taken of its overload capacity. It may here be noted that the generating plant is only called upon to share in the fluctuations when these exceed the capacity of the battery and booster, whereas, if it is desired, in the case of a diverter booster,

to make the generator share the fluctuations, the diverter resistance has to be adjusted to a low value and the sharing process goes on all the time, and not merely when the fluctuations are beyond the capacity of the equalizing plant.

Since control is dependent only on the generator current, over-compounding of the generator can have comparatively little effect on the regulation, the regulator automatically supplying any extra booster field required to meet the compounding, and, if it is desired, the line current or a portion of it can be carried round a compounding coil on the main generator in order to raise the busbar voltage at times of heavy peaks, without its being necessary to provide any special arrangements on the booster. This has been done in practice with the Entz booster.

A notable feature of the Entz system is its simplicity. There is no complicated system of field windings to be designed in accordance with exact theory, and requiring patient adjustment on site, and consequently exceedingly little trouble is experienced in putting it to work.

An important property claimed for this regulator has already been mentioned, viz., that when the balance between solenoid pull and spring tension is disturbed the result, due to the sensitiveness of the piles to change in pressure, is an exciting voltage for the exciter field, and hence an exciter armature voltage in excess of that actually required. This compels the booster field to build up to the required value very rapidly. The makers claim a 3-times effect of this character on the average. The exciter field circuit has a definite time constant, and, whatever voltage is applied to it, the current in the field coil will attain the final value corresponding to this voltage in a definite time. This is to say, the time between application of voltage and attainment of the corresponding final value of current is the same whatever the value of the applied voltage, although the final values of the current will be in direct proportion to those voltages.

Checking Action in Entz Regulator.—It should be noticed that no type of auxiliary checking mechanism is used with the Entz regulator, this being due to the sensitiveness of the carbon piles to changes of pressure. In fact, the Entz system possesses the advantages of both hit-and-miss and rheostatic control. When a pair of contacts on the Tirrill regulator are open or closed the corresponding resistance is either all in or all out, and "all in" and "all out" both mean over-regulation, whereas, with the Entz regulator, the variation of resistance, although very rapid, is also gradual, and when the battery current, caused by a slight increase or decrease in generator current, begins to reduce that increase or decrease, the reduction immediately causes an alteration in the pressure on the piles, which pressure was due to the slight increase or decrease in generator current first mentioned, and which actually was the means of producing the battery current. With the carbon regulator, therefore, rapid action is obtained together with the very important advantage of extreme simplicity.

Methods of Using Boosters.—The ways in which a battery-booster plant can be used are many and varied. Booster sets may be 2-wire or 3-wire, although the latter are not so satisfactory as the former. In 3-wire systems it is quite common practice now to run the battery and booster across the outers of the system like a 2-wire set. A 3-wire set consists merely of 2 sets with a common point at the middle wire of the system. The outline of such a scheme is shown in Fig. 4 for a Highfield booster. The booster on the positive side endeavors to keep a constant load coming from the generator positive lead, the value depending on the setting of the exciter voltage. That on the negative side endeavors to keep a constant current in the negative dynamo lead, the value of this depending on the adjustment of the corresponding exciter. Obviously things

get somewhat mixed if the two exciters are not adjusted alike, as the currents in positive and negative dynamo leads must be the same. For satisfactory working the exciter field regulators have to be interlocked, but even this presupposes an accuracy in design not always obtained in practice. The foregoing remarks, although illustrated by reference to a Highfield set, are not confined to this type of booster.

Exceedingly good results are obtained by the use of the battery and booster directly connected across the outers of the 3-wire system in conjunction with a separate balancer, and, with this arrangement, loads of a very high fluctuating nature can safely be connected across the outers of supply without the busbar voltage being affected. For example, in one station shunt-wound generators are run directly across the outers in parallel with a battery and automatic reversible booster, and a rolling mill motor load is supplied from the same bars as public and general lighting without any adverse effect on the voltage.

Balancing on a 3-wire system where a 2-wire battery and booster are used, instead of being obtained by means of a separate rotary set, may be effected on the armature of the booster motor by means of a choking coil in the middle wire of the system connected to slip-rings on the armature. This, of course, means that the motor armature has to be larger than would otherwise be the case, the increase in size

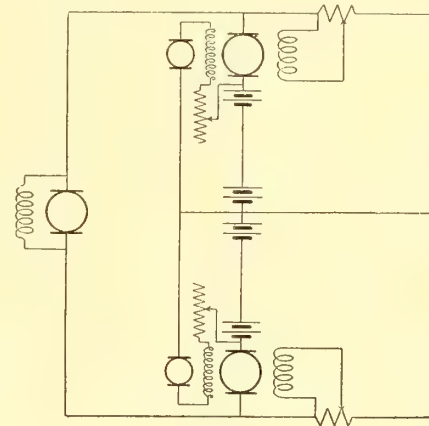


Fig. 4

depending on the magnitude of the out-of-balance current. As an alternative to this the booster may be balancer-driven, in which case the balancer machines require to be made larger than is necessary to deal with the out-of-balance current, the increase in size being dependent on the power required to drive the booster.

Batteries and Boosters for Winding Plant.—Colliery winding and similar work provides an opening for battery-booster plant of an instantly reversible character, provided the initial cost can be kept down. Flywheel sets are often employed, but the large reserve of power in a battery would be a distinct advantage in many cases. There is no necessity to limit the use of this type of winding plant to direct-current systems, as it can be equally well applied to systems in which the supply takes the form of alternating current. The system is, of course, in competition with flywheel equalizers on both alternating-current and direct-current systems, but a flywheel, although it decreases the peak power drawn from a supply, cannot flatten out the demand in the way a sensitive battery-booster plant can, and where power is taken from a supply company and paid for on the basis of maximum demand, this is a point worthy of serious consideration.

The method of using battery-booster plant on alternating-current systems is discussed later in the paper and will be reviewed in the February issue of the *Electrical News*.

Montreal and Eastern Points

Montreal Engineer Tells of Mexico

Mr. John E. Hardman, consulting mining engineer, Liverpool, and London & Globe Building, Montreal, has just returned from La Boquilla, Mexico. Mr. Hardman had some interesting stories to tell concerning hydro-electric power development in Northern Mexico. A dam is being built in a gorge near La Boquilla, which it is said may develop as much as 40,000 or possibly 60,000 h.p. The gorge is 100 feet wide, and the dam will be 200 feet high. There will be a giant spillway about a mile wide. The principal part of the work will be of reinforced concrete. The first unit to be installed will be for 20,000 h.p. This will be increased in accordance with the demand, the expectation being that a second 20,000 h.p. unit will be required about as soon as it can be got ready. This power will be used for mining, manufacturing, irrigation works, tramway operation, or any other purpose desiring it throughout Northern Mexico. Mr. G. F. Greenwood, Canada Life Building, Montreal, is the president of the Mexican Northern Power & Havana Tramways Company, for whom this work is being carried on.

Conference of Wire Manufacturers

A conference was held in Montreal, recently, of representatives of Canadian rubber covered wire manufacturers and electrical inspectors. Mr. G. W. Watts represented the Canadian General Electric Company; Mr. Grant W. Arnold, The Boston Insulated Wire Company, of Hamilton; Mr. C. F. R. Jones, the Imperial Wire & Cable Company, Limited, of Montreal; Mr. H. F. Strickland, of Toronto, the Canadian Fire Underwriters' Association of Ontario; and Mr. James Bennett, of Montreal, The Canadian Fire Underwriters' Association, of Quebec. The discussion dealt largely with the subject of improved installation, and regulations were adopted to this end, to come into effect at a date to be decided upon at a meeting to be held in Toronto in January. A representative of the Underwriters' laboratory will be present to give demonstrations. The new Canadian regulations will be based on the regulations recently adopted at the conference in New York, with certain changes to suit local conditions.

Advertising and Salesmanship

At a noonday lunch of the Electrical Association of Montreal, Quebec, held on November 30, Mr. A. J. Johnson, sales manager of the Robert Mitchell Company, spoke on advertising and salesmanship, especially in relation to the electrical business. Advertising, said Mr. Johnson, was nothing more than salesmanship; they could not separate the two. He strongly urged the advisability of good, truthful advertising, which must be lived up to in order to be effective. In the United States certain campaigns had had the same effect as protective tariffs, in that they resulted in the sale of domestic goods to the exclusion of imported articles. Those of them who were in the fixture business believed that they could make goods equal to, if not better than, those imported. There was no doubt an idea that foreign things were better, but he contended that this impression was a wrong one. Advertising was not confined to mere printing; the putting in of good or bad fixtures was in itself a method of advertising, and if the goods were defective, it was advertising in a wrong fashion. Mr. Johnson insisted upon attention to small things, as a means of advertising the particular goods in which they were interested.

Underground Tramways

With a view to bringing the long-talked-of scheme of underground traction into more definite form, the Montreal council has empowered the city attorneys to prepare a draft amendment to the charter authorizing the city to construct underground electric tramways. Further, to draft an amendment asking for authority to construct a double line of street cars on each side of the proposed city aqueduct from Montreal to Lachine, and if necessary to operate the same with electricity or any other power except steam. When these powers have been secured from the Quebec Legislature, the city will decide who will construct and operate the lines.

Judgment for \$40,000

Mr. Justice Greenshields has given judgment for \$40,000 in the action of H. L. Frank v. John Forman, ordering the return of the money, with interest, for the loss of the Jacques Cartier Water Power. The case for the plaintiff was that when Forman purchased the Sewell property, also known as the Jacques Cartier Power, as it comprises the falls of the Jacques Cartier River, a loan of \$40,000 was made by plaintiff to defendant to be used in the development of the power. Defendant always neglected to use the plaintiff's money for the purpose, and finally, when called up to pay the loan or to carry on works that would turn the falls into profitable power development, claimed that an extension of time was necessary, and that the loan had to be forcibly continued. The Judge was against this view of the defendant, and gave judgment accordingly.

Another Pearson Organization

Mr. David M. Shaw, Montreal, has been appointed to the staff of a company responsible for a large hydro-electric development in Barcelona, Spain, and being organized by Dr. F. S. Pearson, of New York. Mr. Shaw, who is a Montrealer, was for several years in the employ of the Street Railway Company. He later entered the employ of the Montreal Light, Heat and Power Company in connection with their construction work at Chambly, and from there went to Mexico in the employ of the Mexican Light and Power Company. Latterly, he has been identified with the Canadian Light and Power Company's development, being employed by one of the contractors on that work.

Talk on Shawinigan Plant

On Tuesday, December 5th, Mr. J. C. Smith, chief engineer and general superintendent of the Shawinigan Water & Power Company, Montreal, read a paper before the members of the McGill Electrical Club, descriptive of the hydro-electric generating plant at Shawinigan Falls. The paper was illustrated with slides, and proved of exceptional interest. The students will have an opportunity of seeing the plant in operation this month, as they have accepted an invitations to inspect the various apparatus at the Falls.

Is Vice-President of Association

Mr. James Bennett, chief electrical inspector of the Quebec branch of the Canadian Fire Underwriters' Association, will attend the convention of electrical inspectors to be held at Milwaukee on January 22-24. Mr. Bennett is the vice-president of this body. While away he expects to spend a week or so in the Underwriters' laboratories studying the latest methods of electrical tests in the Underwriters' Institute for the benefit of the Canadian Fire Underwriters' Association.

Current Montreal Notes

The Shawinigan Water & Power Company propose to issue \$500,000 4½ per cent. debenture stock, making a total issue of \$5,000,000 of this stock.

Mr. Guy M. Gest recently lectured before the Canadian Society of Civil Engineers on the subject of "Underground Conduit Construction."

Mr. R. L. Calder, advocate, was the speaker at a recent luncheon held by the members of the Montreal Electrical Association, the topic being "Law and Electricity."

The members of the McGill Electrical Club visited the factory of the Imperial Wire & Cable Company, Guy street, Montreal, and were shown the various processes in the manufacture of the company's productions.

The Eastern Canada Power Company, Limited, Montreal, has been incorporated, with a capital of \$1,000,000, divided into 10,000 shares of \$100 each, to carry on the business of an electric light, heat and power company.

Mr. E. W. Sayer, of the Sayer Electrical Company, Montreal, will be a candidate for the St. Lawrence ward at the coming municipal elections. He is in favor of underground tubes, but pending their construction, advocates new car routes.

Mr. H. D. Crouch has resigned the position of district manager of the Northern Electric and Manufacturing Company, Limited, Montreal, and is succeeded by Mr. E. C. Peterson. Prior to leaving, the office staff presented Mr. Crouch with a sterling silver smoking set, suitably engraved.

With a capital of \$500,000, the Deschambault Electric Company, Limited, has been registered for the purpose of acquiring lands, licenses, water power and rights, electric light stations and powers, for the distribution and furnishing of water and electricity. The office is at Montreal.

The noonday luncheons and talks of the Electrical Association of the Province of Quebec, Montreal, are a pronounced success. The attendance is growing almost weekly, and the talks, sometimes on general topics and sometimes on technical subjects, have been excellent in matter and of interest from the contractor's point of view.

A list of shareholders holding over 200 shares in the Montreal Light, Heat & Power Company has just been published. This shows that the Montreal City and District Savings Bank is the largest holder, with 3360 shares, Mr. H. S. Holt coming second with 1932, and the Hon. L. J. Forget third with 1713. There are several people with 1000 and over to their credit.

The International P-A-Y-E Tramcar Company, with offices at Montreal, has been incorporated for the construction and repair of tramways, cars, wagons, locomotives, engines, and generally of all material and accessories connected with railways; also for the construction and sale of motors, boilers, electrical apparatus and other machinery. The capital is \$3,750,000.

At a joint meeting, recently held in Chicago, of the eastern and western divisions of the Association of Railway Telegraph Superintendents, Canada was represented by Mr. W. J. Camp, electrical engineer of the telegraph department of the C. P. R.; Mr. W. Marshall, superintendent of the C. P. R., Toronto; Mr. W. W. Ashald, superintendent of telegraphs, G. T. R., Montreal, and Mr. A. D. Smith, of the

Northern Electric and Manufacturing Company, Limited, Montreal.

The Board of Control of Montreal have taken up with Mr. Chausse, chief building inspector, the question of defective electric wiring in connection with moving picture shows and instructions have been given to close such theatres as do not conform with the city's by-laws and whose proprietors do not obtain a certificate from the electrical department of the Canadian Fire Underwriters' Association.

The Wire & Cable Company, Montreal, is now known as the Imperial Wire & Cable Company, Limited. There will be no change in the management. The company report that business is excellent, the following contracts, among others, having been secured: for the City of Winnipeg, large quantities of weather proof wire; for the City of Calgary, insulated lead-covered power cable; also a quantity of weather-proof wire for British Columbia.

Questions and Answers

Q.—Explain how one wire from the secondary winding of a spark coil as used on some gasoline engines (the other wire does not show) gives the necessary spark when brought into contact with any metal body.

A.—It does not appear that there is more in your question than that the other wire which does not show is grounded, probably to some part of the metallic apparatus around the engine. This is the usual way in setting up these engines. It might follow that the frame to which this ground is made might not have good contact with the earth and so may become charged statically. In this way it would be at the same potential as the terminal to which it is directly connected and by bringing the wire from the visible terminal to any point in this frame, you would be bringing together two points having the same difference of potential as the two binding posts of the spark coil. It is not necessary however that the piece of metal to which you bring your visible terminal should be in metallic contact with the invisible post, as the two terminals of an induction coil are at widely different potentials relatively and it may be, if they are well insulated, also at different potentials, from metals in their neighborhood. It may happen, for example, that one terminal of an induction coil is positive to the earth and the other negative, and you would probably get a spark by bringing either terminal in contact with a metal that was earthed. If there is any more in your question than appears on the surface we shall be glad to give fuller explanation.

Q.—Can a small induction motor or a watt hour meter be made with cast core instead of laminated core in the field that will show as small losses in operation?

A.—We do not think it would be possible. The difficulty with solid metal core is that eddy currents are set up which have the effect of interfering with the primary and secondary currents. These eddy currents are best overcome by laminations placed in such a plane as not to offer resistance to the magnetic lines of force threading the field of the coil, but which do retard the eddy currents which flow at right angles to the lines of force. Then, too, eddy current effects vary with conditions, as, for example, temperature, to a very great extent. Much also depends on the material in the cores since permeability differs widely with the core content.

Great Activity on the Western Coast

Bull River Power Co. Changes Hands

George Henderson and Herman Schultz, formerly in control of the Bull River Power Company, which for several years has been working on a hydro-electric system on the Bull River, some miles from Wardner, B.C., have disposed of their interests to a syndicate of capitalists headed by M. A. Devitt and H. W. McCoy, of Chicago. The new owners propose to spend a million dollars inside the next twelve months on the completion of the plant and the construction of power lines. The directors visited the plant about the middle of November, being accompanied by Professor Mead, of Wisconsin University, an electrical engineer of universal reputation, who is acting in an advisory capacity for the new board. The company will immediately install a plant sufficient to generate 10,000 h.p., which will be added to as business warrants. A six-strand duplicate power line on steel towers will be carried from the plant at Bull River Falls over the Lizard Pass to Fernie, and on through the Crow's Nest Pass to Frank, Alta. The cost of the power line will approximate \$5,000 per mile.

B. C. E. R. Section N. E. L. A.

The British Columbia Electric Railway Company's section of the National Electric Light Association held a most enjoyable musicale and social recently, being the first of a series of such evenings planned to be given throughout the winter. The musical part of the programme was rendered more enjoyable by the fact that General Manager Sperling, on behalf of the B. C. Electric Railway, recently presented the section with a magnificent piano, which was used for the first time. Manager C. Rummel, president of the section, occupied the chair during the evening. Brief addresses were given by Mr. J. G. Lister, relative to the 1912 convention of the N. E. L. A., to be held in Seattle next May; by Vice-president L. B. Robinson, who pointed out that the B. C. Electric Railway paid a heavy fee for membership in the N. E. L. A. so that its employees might share in the benefits of the organization by paying merely for the literature issued; and by Chief Engineer G. R. G. Conway, the last speaker, who congratulated the section on its excellent organization and promised to do all in his power to advance its interests.

Vancouver Street Clusters

Vancouver was slow in adopting the ornamental street cluster lighting system, but it is now making amends. These lights already line three miles of the busy portions of Hastings and Granville streets, and will be shortly erected on four additional streets—Main, Alexander to Bridge, Pender, Granville to Main; Hastings east, Main to Jackson; Cordova, Granville to Main, which will add an extra five miles. Assistant Electrician Hughes also proposes to pass the following additional streets: Georgia, from Granville to Stanley Park; Pender west, from Granville to Georgia; Powell, from Carroll to Campbell; Hastings, from Jackson to Campbell; Campbell, from Powell to Harris; Harris, from Campbell to Main; Main, from the bridge to Broadway; and Granville, from the bridge to Broadway. These, if approved, will add another fourteen miles to these attractive lights, and make twenty-one miles in all. Construction work is expected to begin early in the new year. The city bears one-fourth of the cost of the lighting and maintenance, the cost of installation and three-fourths of the lighting expense being borne by the property-owners.

Good Street Lighting

In the near future Victoria will be one of the best lighted cities on the continent. The arc lighting system is being steadily extended to the outlying streets, there being now 629 arcs in use. When the civic plant was installed in 1895 the lamps required attention about every sixteen hours—now they will burn for 200 hours. New ornamental cluster lights are now installed on a number of leading thoroughfares, and it is the aim of the electrical department to ultimately bring the whole of the business portion of the city within the cluster lighting area. Additions to the city power station are being made to meet the enlarged service to be given, and a large quantity of new equipment of various kinds has been purchased. The old machinery and equipment will be disposed of by degrees as replaced.

Prince Rupert Hydro-Electric Development

Considerable preliminary work has been completed this season by the Prince Rupert Hydro-Electric Company at Khatahda Falls, some fifty miles up the Skeena, where the Khatahda River joins it. The development scheme as at present contemplated would involve the expenditure of about \$1,500,000. It is understood that the capitalists interested are those back of the Western Canada Power Company, whose great plant at Stave Lake will soon supply cheap power and light to the citizens of Vancouver and all possible users within serving distance of the power line, which extends over thirty-five miles of territory.

First Prosecution Failed

The first prosecution under The Provincial Tramways' Act resulted in failure. It was brought by Thos. Rae, inspector of tramways, against a Vancouver conductor of the British Columbia Electric Railway Company for allowing passengers to ride on the steps of his car. The magistrate ruled that, according to the evidence, the people rushed and boarded the car before it left the station, and the conductor had no opportunity of showing whether he was going to permit them to ride there or not. His Worship said that he did not mean to hold that there must be express allowance before there could be a prosecution, but that the will must have been proved to have been exercised in one way or another.

21,000 h.p. on Puntledge River

In connection with the extensive development work to be carried on during the ensuing twelve months by the Canadian Collieries, Limited, on its coal measures at Cumberland, Vancouver Island, for which the sum of \$1,600,000 has been appropriated, it has been decided to expend a half million dollars on the development of the water power on the Puntledge River, the object being to furnish electric power for the mines. The contract has been awarded to Grant, Smith & Company, electrical engineers, of Victoria. It is proposed to develop 21,000 h.p. hydraulically, fifty per cent. of which will be mechanically developed, leaving the remainder in reserve for future use.

Mr. Wynn Meredith, consulting engineer for the city of Victoria on the Sooke Lake water supply, and for the B. C. Electric Company on the Jordon River power plant, is at present enjoying a holiday at his home in San Francisco after an absence of three months on Vancouver Island.

Miscellaneous

The city of Lethbridge recently asked for tenders to increase the electric power capacity by about 1,500 kilowatts, or sufficient to supply all the needs of the proposed street railway system.

The electric unit, in connection with the salt water high pressure system being installed in Victoria, is now nearing completion. The new pumps will each be capable of delivering 25,000 gallons per minute at 150 pounds pressure.

The high potential wires carried over the railway bridge at New Westminster are to be elevated another 25 feet, or 185 feet in all, in order that sailing vessels carrying tall masts may be able to ascend the river for lumber cargoes without having to unstring any of their top hamper.

Vancouver Board of Trade recently petitioned the Ottawa Government to erect additional wireless telegraph stations at Alert Bay and Swanson Bay, as at present there is no station in the dangerous zone of navigation between Cape Lazo and Prince Rupert, a distance of 400 miles.

D. P. Roberts, provincial inspector of electrical energy, and Mr. William Rae, provincial inspector of tramways, returned several weeks ago from an inspection trip through the Nelson district. Among the plants visited were the West Kootenay Power Company and the Nelson Street Railway Company, at Upper and Lower Bonnington Falls.

The linemen in the employ of the British Columbia Telephone Company were successful in their efforts to convince a joint board of arbitration that the increased cost of living justified a demand for an increase of 25 cents per day over their present wage of \$3.75 per day for eight hours. The decision benefits 250 men, the company having promised to abide by the award.

The Vancouver section of the American Institute of American Engineers, held a dinner at the Dutch Grill a short time ago, when a large number of electrical engineers were present. An interesting paper was read by L. G. Robinson, of the British Columbia Electric Railway Company, on the subject of "The Generating and Transmitting Systems of the British Columbia Railway Company."

Good progress is being made by the contractors in charge of the construction work on the B. C. E. R. Company's new city and interurban station and office building at the corner of Hastings and Carroll streets, Vancouver. The company officials are at present occupying cramped quarters in the Holden Block, which will have to be retained till June next, and perhaps longer.

The telephone system in Victoria is extending very rapidly, the increase in ten months numbering over 1,100 services, total number standing on November 1st being 4,970. By the beginning of the year the new central exchange on the corner of Blanchard and Johnson streets is expected to be in operation. The switchboard now being installed will accommodate 10,000 services.

The B. C. Electric Company recently added to its equipment another new Baldwin steam freight locomotive of powerful type. These locomotives are used for emergency purposes in the event of lack of current rendering the elec-

tric engines useless for the time being. However, they are frequently made use of when heavy trainloads of logs have to be brought in from points on the Fraser Valley line.

The reports and accounts of the B. C. Electric Railway Company, Limited, for the year ending June 30, disclose a total investment in the province of \$25,500,461. The net profits of the year were \$1,781,221. From this amount there has been written off the sum of \$420,760 for renewals, obsolete steam plant, and other items of similar nature. This deduction leaves a net profit of \$1,363,461, which is equivalent to a return of five per cent. on the total invested capital. The annual meeting of the stockholders will be held in London in the near future.

At a recent meeting of the Vancouver Board of Trade a motion was introduced asking the Provincial Government to withdraw all water rights and privileges held by any persons who were not actual settlers on the lands where such rights were situated, and further directing that the government inaugurate a hydro-electric system similar to that of Ontario, the board considering that cheap power for manufacturers is necessary for the economical development of the province and of industries in this city. The mover, Chas. Woodward, claimed that Vancouver people paid more for electric light and electric motor power than the people of almost any other city of equal population. Action on the motion was postponed.

The various mining and smelting companies at Rossland, Trail, Grand Forks, Greenwood and Phoenix, B.C., learned with keen satisfaction of the settlement of their dispute with the West Kootenay Power & Light Company at Bonnington Falls, over the question of power rates. The Power Company announced its intention to make a substantial increase in rates, whereupon the users of power entered a strong protest, claiming the profits would not stand a higher rate. The matter was referred for decision to Mr. W. M. Douall, of Montreal, president of the Light & Power Company, who stated that while the proposed increase was fully justified, it was not the intention of the company to increase the rates at present, owing to the low price of copper.

Demise of a Zealous City Official

By the death of J. A. McCrossan, city electrical engineer, which occurred December 8th, Vancouver lost a public servant of recognized probity and admitted skill in his profession. Recently granted four months' leave of absence by the city council owing to ill-health, his condition quickly became so serious that he was unable to leave for southern California as planned, and passed away at the residence of his parents, Mr. and Mrs. Thos. McCrossan, 759 Bute street. The deceased was born in 1867 at Chatham, Ont., and removed with his parents to Winnipeg in 1879. Choosing electricity as his calling, he was one of the first four Canadian electrical engineers to become members of the American Institute of Electrical Engineers. In 1884 he removed to Kenora, Ont., then Rat Portage, where he organized the Citizens' Telephone & Electric Company, of which he held the managing directorship until his removal to British Columbia in 1903. The large hydro-electrical plant installed by him at Kenora was one of the first of its kind in Ontario, and at that time one of the largest. Shortly after arriving in Vancouver Mr. McCrossan was appointed city electrician, and his occupancy of the office was marked by splendid initiative work and unflinching attention to all matters coming within his department. A prominent Mason and Independent Forester, a leading liberal and an enthusiastic supporter of all athletic sports, the deceased will be greatly missed in many circles.

Electric Railway Progress

M. & S. C. Extensions

The Montreal & Southern Counties Railway have under consideration an important scheme of development, which, if fully carried out, will embrace a system of 300 miles. The contemplated extensions will take two or three years to complete, and are necessitated by the increasing population of the towns along the south shore of the St. Lawrence. We have already mentioned the extension to Chambly, which is now under construction, and which will be completed in 1912. The Longueuil line will be continued east to Boucherville, while the Chambly line will be continued from Richelieu along the east side of the Richelieu River, where it will touch St. Mathias, St. Hilaire, St. Charles, St. Denis, St. Ours and other points along that river, to Sorel. At present the district is very poorly served with railway communication, as with the exception of the town of Sorel and the village of St. Hilaire, none of the villages or municipalities have any railway facilities or communication whatever, and have to team their produce a distance of from eleven to thirteen miles to the nearest railway station. The country traversed by the proposed line is capable of considerable development, and it is believed that the line would open up and serve a section adjacent to and on both sides of the Richelieu River.

Next season work will be commenced on a line from St. Lambert to Laprairie, which it is hoped to ultimately extend, in a loop line, to tap the districts to the south and west thus serving the counties of Chateauguay, Napierville, Huntingdon, St. Johns and Laprairie.

As a result of a visit of the officials over the Montreal and Province line (which forms a part of the Central Vermont system), Mr. E. H. Fitzhugh, president of the Montreal and Southern Counties road, has instructed Mr. B. J. Arnold, of Chicago, to prepare a report upon the electrification of the Montreal and Province line. The idea is to make the road a section of the Southern Counties system. Mr. Arnold, who formed one of the visiting party, is a leading electrical expert of the United States and the firm with which he is connected was responsible for the electrification of the St. Clair tunnel of the Grank Trunk.

The Southern Counties Company, of which Mr. Powell is the vice-president and general manager, is still pressing on the Montreal Council the urgency of extending its line from the city terminus to St. Catherine street, thus affording easier access to and from the South Shore.

Remuneration of B. C. Tram Employees

The new wage schedule of the B. C. Electric Railway Company for Vancouver, Victoria and New Westminster is now in effect. General increases in wages are noted, the schedule being:

Division No. 109, Victoria, B.C.: New rate, first three months' service men, 22 cents; second three months, 25 cents; second six months, 27 cents; second year, 29 cents; third year, 31 cents; those of three or more years of service, 35 cents upon city lines, and 36½ cents per hour upon interurban lines. Rate of increase, 6 per cent. to 10 per cent.; aggregate annual increase, \$18,000. The old schedule ran from 20 cents to 31½ cents.

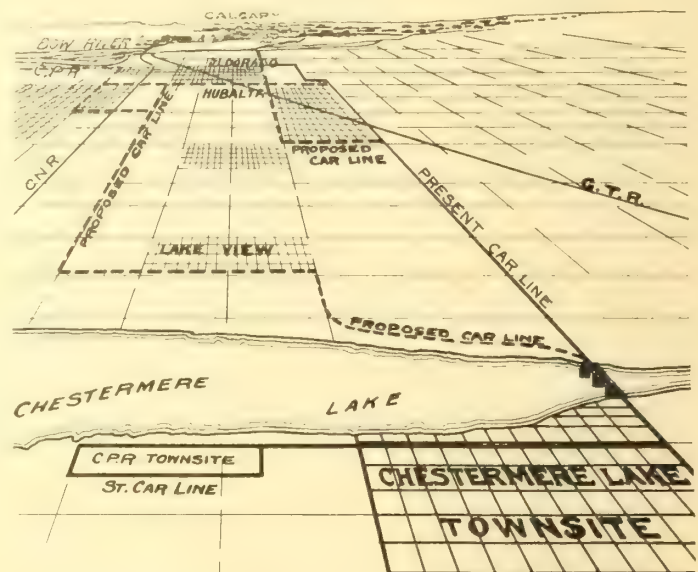
Division No. 101, Vancouver, B.C.: New rate, first three months' service men, 22 cents; second three months, 25 cents; second six months, 27 cents; second year, 29 cents; third year, 31 cents; for those of more than three years' service, 35 cents per hour upon city lines and 36½ cents per hour upon interurbans. Rate of increase, 6 per cent.

to 20 per cent.; aggregate annual increase, \$82,000. Rates were increased from: First three months, 20 cents; second three months, 23½ cents; second year, 26½ cents; third year, 27½ cents; fourth and fifth years, 28½ cents; sixth and seventh years, 29½ cents; eighth, ninth and tenth years, 30½ cents and thereafter, 31½ cents per hour.

Division No. 134, New Westminster, B.C.: New rate, first three months' service men, 22 cents; second three months, 23 cents; second six months, 27 cents; second year, 29 cents; third year, 31 cents; more than three years' service, 35 cents per hour upon city lines, and 36½ cents per hour upon interurban lines. Rate of increase, 6 per cent. to 20 per cent.; aggregate annual increase, \$27,280.

Chestermere-Calgary Railway Location

The accompanying cut shows the location relatively to Calgary of the new Chestermere-Calgary Electric Railway system now being installed. It will be seen that the ultimate plan of the company is quite comprehensive and that



Line of Chestermere-Calgary Electric Railway

a fine residential section in the neighborhood of Calgary will thus be opened. As shown in the drawing, Calgary will now be well supplied with transportation facilities. They have a very fine municipal street railway system, the G.T.R., C.P.R. and C.N.R. have entrance there and now an up-to-date street car line in the suburbs completes the list.

Car Ventilation

An address was recently delivered by Dr. W. A. Evans, former health commissioner of Chicago, before the annual convention of the Association of Railway Electrical Engineers held at Chicago during November. Dr. Evans commenced by condemning deck sashes unconditionally as being of no service at all for ventilation purposes. He stated that the air coming in through the deck sash goes out through the deck sash on the opposite side. One important objection was that the air coming in in this way, if it penetrated into the car at all, came down cold on the people's heads.

The proper method, according to Dr. Evans, required that air should be taken in the cars at or near the floor line. It should come into the car through radiators so as not to chill the occupants. The outlet should be at or

near the ceiling. In addition to this air should be properly cleaned and should not be too moist. Changes in temperature are much more noticeable where the air is too humid. The intake of clean air raised the question of whether the dust was gathered unduly if the opening was near the ground. Dr. Evans does not think so. He is of the opinion that dust follows a street car and that air taken in near the front of the car even though the opening is near the ground will contain no more than the average street car amount of dust.

Electric Railway for Porcupine

Notice has been given that an application will be made to the Legislative Assembly of the Province of Ontario at the next Session thereof for an Act to incorporate the Porcupine Rand Belt Electric Railway Company, with power to construct and operate a line of railway from a point at or near the eastern boundary of the Province of Ontario in the Township of McGarry, thence westerly and southerly to a point at or near the Townsite of Larder City, thence westerly through the Townships of McVittie and Hearst, Gauthier and McElroy, Lebel and Boston, to a point at or near the Townsite of Dane, and crossing the line of the Temiskaming and Northern Ontario Railway Company by a separation of grades, thence westerly through the Townships of Otto and Teck, Grenfell and Eby, Burt and Holmes, Alma and Baden, to a point at or near the head waters of the Montreal river, thence westerly through the Townships of Robertson, McNeil and Argyle, Hincks and Cleaver, Geikie and Bartlett, Musgrove and Doyle, to a point at or near the eastern shore of the Matagami river, the expansion of which here is known as Kenogamisse Lake; with power to construct branches or extensions at different points along the route and to connect with the Temiskaming and Northern Ontario Railway and other railways that may be built; and with power to operate the said railway by steam, electricity or otherwise; and for such other powers as are usually given to railway companies.

Current Consumption Under Varying Conditions

During three days of September an interesting series of tests were made on a suburban section of the Detroit United Railway System to determine the relative current consumption under three conditions, (a) a single inter-

urban motor car; (b) the same motor car hauling a trailer; (c) a 2-car multiple unit train consisting of the same motor and trailer, the trailer now equipped with motors. The following remarks are gleaned from a current issue of the Electric Railway Journal.

For the purpose of these tests two of the company's regular interurban cars were taken out of service and fitted up with the various instruments required. The cars used were of the single end type, 41 foot, 10½ inch bodies, seating capacity 53. The trucks were Baldwin M. C. B. type, 6 foot, 6 inch wheel base, 36 inch wheel. Each car was equipped with four 75 h.p. motors with electro-pneumatic control.

The results of the runs made on three consecutive days under conditions which were kept as nearly identical as possible are shown in the annexed table. The cars were numbered 7306 and 7307. Number 7306 was used in each of the three tests. Number 7307 was used first with motors installed and then with motors removed as a trailer. The cars were run at the same schedule speed and made the same stops as nearly as possible. Two ammeters, two voltmeters and two wattmeters were used so that one instrument would check up the others. The meters were so arranged that the power consumed on both cars was measured and a separate wattmeter was used to measure the lighting and storage battery consumption. Temperatures of the motors were taken between the armatures and pole pieces at the start and finish of each trip.

As the principal object in making these tests was to determine the relative current consumption of one-car and two-car trains, the watt-hours for the ton mile shown in the summary are of particular interest. The motor and trailer-car train consumed for the motors alone only 60.06 watt-hours per ton mile as compared with 73.51 watt-hours for the single-car and 68.66 watt-hours for the multiple-unit train. The car hauled as a trailer was much heavier than a specially built trailer of the same seating capacity, so that the possible saving in energy under normal operating conditions should be much larger than appears from the tests. No difficulty was experienced in maintaining the schedule speed with the trailer car, and it is significant that the increase in temperature of the motors on the car hauling the trailer was but little more than the increase of temperature when operating as a multiple-unit train, and was well within safe limits for the insulation.

SUMMARY OF POWER CONSUMPTION TESTS ON RAPID RAILWAY DIVISION, DETROIT UNITED RAILWAY

Dates	Sept. 12, 1911		Sept. 13, 1911.		Sept. 14, 1911.
Make-Up of Train.	Two Motor Cars.		Motor Car and Trailer.		One Motor Car.
Cars.....	No. 7,306	No. 7,307	No. 7,306	No. 7,307	No. 7,306
Motors.....	4 West. 112	4 West. 112	4 West. 112	None	4 West. 112
Gear ratio.....	30:59	30:59	30:59	None	30:59
Trucks, type.....	Baldwin	Baldwin	Baldwin	Baldwin	Baldwin
Controller, type.....	West. Pneumatic	West. Pneumatic	West. Pneumatic	None	West. Pneumatic
Weights, pounds.....	69,240	65,400	69,240	51,360	69,240
Average volts.....	432.3		476.2		485.
Average amperes.....	378.		251.2		188.
Total kw-hours for motors.....	271.4		212.6		149.4
Total kw-hours for batteries and lights.....	8.3		5.8		5.
Total kw-hours consumed.....	279.7		218.4		154.4
Distance, miles.....	58.7		58.7		58.7
Watt-hours per ton mile for motors.....	68.66		60.06		73.51
Total watt-hours per ton mile.....	70.778		61.701		76.

Temperatures, Degrees Fahrenheit.

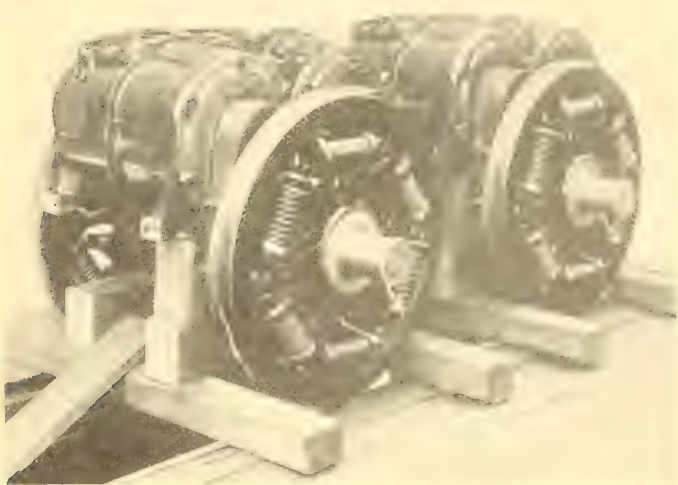
Average in motor at start.....	87 25	75 5	91 5		60
Air temperature at start.....				55	62
Above air in motor at start.....	23 25	11 5	36 5		-2
Average in motor at end.....	137.	122 5	145		130
Air temperature at end.....				62	66
Temperature in motor above air at end.....	75	60.5	83		64
Increase in motor temperature.....	49 75	47	53 5		70

Saskatoon Electric Railway Company

Application will be made to the Saskatchewan Legislature at its next session for an act to incorporate the Saskatoon Electric Railway and Power Co., with power to construct, operate and maintain an electric street railway on the highways and elsewhere within the city of Saskatoon and within a distance of twenty-five miles beyond the boundaries of the said city and to acquire the rights of one H. M. E. Evans under a certain contract made between him and the said city in respect of the construction of such street railway; to construct, maintain and operate plants operated by water, steam or otherwise for the generation of electricity and to distribute electric energy for all purposes, with all other usual and necessary powers.

Modern Locomotive Design

The latest single-phase locomotive built by the Westinghouse Company and illustrated herewith is equipped with 4 driving axles. Each axle has 2 motors so that the locomotive is operated by a total of 8 motors. The 2 motors on each axle are 2 single-phase machines geared to a quill



Two Single-phase Machines Operate each Axle

surrounding the axle. This arrangement, which at first sight appears more complicated is said to be in reality a lighter, cheaper and more simple construction than that involving a smaller number of motors with the same total capacity.

Miscellany

It is said the city council of McGregor will probably grant a franchise to Mr. J. D. McGregor representing an English company who will equip and operate a street railway system in that city.

By agreement with the London Street Railway the city is entitled to a mile of track for every 2,000 population. At the present time the council is figuring that about two miles of extensions should be made.

A by-law will be submitted providing for the issue of debentures to the amount of \$140,000 to provide for the building and equipping of a double street car line on Danforth avenue, Toronto.

Under the new management the St. Thomas Street Railway system is making a very satisfactory showing. During the past eight months 62,328 more passengers were

carried than in the same period a year ago, and the receipts increased, covering this same period, by \$2,214.

The Quebec Railway, Light, Heat & Power Co. have secured water rights on the first thirty miles of the Saguenay river from Lake St. John. It is proposed early next spring to erect a 50,000 h.p. plant on the river, with a view to meeting the increased demand for power in the city of Quebec and district.

The street railway system of Edmonton which is operated by the municipality will show a deficit of some \$35,000 for the current year. This is even larger than a year ago. It is now said that it will be necessary to increase the rates to a straight 5c. fare before there is any chance of this system being placed on a paying basis.

At a recent meeting called in the interest of the Nelson Street Railway shareholders, Mr. J. E. Taylor read the financial statement which indicated considerable gains made by the system during the last few months. It was stated that now the system has shown itself capable of yielding good profits the citizens will be asked to purchase more stock to pay outstanding indebtedness.

Mr. Robert, president of the Montreal Tramways Company, has promised a programme of extensions and general improvements. He puts all the blame for the congestion upon the city, who, he says, has denied the company permission for new car lines. Mr. Robert advocates the opening up of new routes, fewer stops, and the proper regulation of traffic in order to obviate unnecessary delays.

Notice has been given by the Berlin and Bridgeport Electric Street Railway Company that application will be made to the legislature at the coming session to change the name to the Berlin and Northern Electric Railway Company. The capital stock will also be increased to \$400,000. Extensions will be made from Bridgeport to Elora and Fergus. Power is also asked to generate and sell electric energy and to construct and operate telephone lines.

A message from London, England, states that the Privy Council has reserved judgment in the case of the City of Montreal vs. the Montreal Street Railway Company (respondents) and the Attorney-General of the Province of Quebec (intervenants). Last year the City of Montreal entered a complaint against the Park and Island Railway Company because it was charging ten cents between Mount Royal Vale and the other parts of the city, nominally for the trip round the mountain. The case was heard before the Railway Commission, and lost by the city. It was appealed to the Supreme Court of Canada, and again lost by the city. One of the points involved is the jurisdiction of the Railway Commission.

The city's rapid growth is taxing the ability of the British Columbia Telephone Company to keep pace with the demands of the citizens for new services. To add to the troubles of the officials, the ratepayers are evincing a pronounced predilection for the removal of all poles from residential as well as business streets, and have same placed in lanes. Property owners in Hastings Townsite, one of the several ambitious suburbs, recently complained to the city council of the refusal of the company to sign an agreement that it would do away with wooden poles on certain streets within ten years, whereupon the company reminded the city that the streets were the only places the lines could be put at the present time, many of the lots being in bush and the lines not being opened up or even surveyed.

Canadian Telephone News

The sixth annual convention of the Canadian Independent Telephone Association was held in Toronto on November 15th, and in point of interest displayed and results accomplished is easily the most satisfactory meeting yet held by this association. The president, Dr. W. Doan, occupied the chair, and in his opening address reviewed the Independent Telephone situation very clearly and forcibly. Dr. Doan's address is re-printed in full below. The greater part of the discussion centred around the draft of the agreement which the Bell Telephone Company has submitted to the Dominion Railway Board, and which is to be considered by the Board at an early date. Mr. Gamble, counsel for the Independent Association, reviewed this agreement and pointed out certain sections which were not satisfactory to the Independents and must necessarily be fought before the Railway Board. A committee was appointed to consider this matter carefully, and if necessary draft another agreement representing the views of the Independent Companies.

The President's Address

It was in 1905 that the Select Committee on telephone systems held their investigations in Ottawa. The evidence produced showed that at that time, with few exceptions, the Bell Telephone Company controlled the situation, and rarely extended their telephone systems beyond the cities and towns. They were, as it were, in full possession of the fat portions of the country, and the lean and rural portions they were leaving severely alone.

Since the publicity given the above committee's report and the organization of our Canadian Independent Telephone Association, it is wonderful to note the rapid increase in telephone companies formed, and the ever-increasing number of telephones in actual daily use. According to the latest returns obtainable, we find that there are 340 systems reported in Ontario in 1910. Of this number of telephone companies less than one hundred were incorporated. This state of affairs leads one to the conclusion that the subject of incorporation has not received due consideration by the owners of rural telephone systems in Ontario. Unincorporated telephone systems have no legal standing in the courts of law, and each shareholder or member is personally liable as an individual for debts or liabilities owned by the telephone system of which he is a member. In case of action for damages each member of the telephone system might be held personally liable and his private property levied against, while his less prosperous neighbor would escape all litigation.

In an incorporated company the stockholder is only liable for the full amount of stock that has been allotted to him. Thus, when the shareholder has paid for his stock in full, his liability ceases, the company alone then being responsible, no matter what happens financially to the undertaking. It is thus evident that the best interests of all shareholders of each telephone system would be served by having their telephone system incorporated under the laws of the province in which it exists.

The necessary blank forms for incorporation can be secured by making application to the Provincial Secretary, Parliament Buildings, Toronto, for the Province of Ontario. We will not enumerate all the conditions necessary to secure telephone charters of incorporation in Ontario, but will dwell briefly on the more important requirements:

1. A certified copy of the by-law for each municipality in which it is proposed to operate, granting permission to erect poles and wires along the highways, must accompany the application for incorporation.

2. At least sixty per cent. of proposed capital must be subscribed or underwritten.

3. The incorporation fee is placed at \$25, which fee is reasonable when you consider the protection the shareholders receive.

The telephone business is a peculiar business. It is surprising the appetite a normal healthy telephone system has for new money for ever-wanted and demanded extensions of the system. I doubt very much if these requirements had been demanded of us in the pioneer days of independent telephony, if there would have been the rapid growth that we had. A majority of our companies had a small beginning, with the primary object of securing local telephone service to their community, and incidentally produce a reasonable dividend on the money invested.

Many a system has started with ten or twelve telephone users, and by now can boast of four or five hundred subscribers. If you were to ask any of the early directors of these companies as to their original plans and expectations, you would be informed that a system of fifty or one hundred telephones was their ultimate expectation, while today they have four or five times as many telephones as they originally planned and built for. Now if this system had had to have at least sixty per cent. of its authorized capital subscribed before it was incorporated, its directors would have realized long ere this that their company had too small a capital authorized by incorporation, or have found the incorporation requirements such that they could not secure a pledge or sale of the required sixty per cent. for incorporation purposes. It is poor policy to have on hand cash capital, over and above what is necessary for the current construction work. By that I mean—supposing you had a capital of \$40,000, it would be useless to have \$30,000 paid up, and drawing only bank interest, when you need only \$10,000 for immediate use.

Make Incorporation Easy

As to the municipal by-laws, we have all had more or less experience with municipal councils and the seeming needless aggravating delays in having the matter dealt with. Our provincial government should, while safeguarding against abuses, make the incorporation of telephone companies as easy as possible, since the telephone is looked upon by everyone as a necessity. The ring of its bell is a common sound in the farm house to-day. To the traveller of our country road, the most striking feature is the continuous evidence of the growth of the rural telephone. Even the more remote and less settled districts have their pole lines like a network along the highways, with branch lines here and there connecting up some distant farm home which, with a telephone, is no more isolated than a house in the city or town. The farmer can call his neighbors to help him thresh, inquires the prices of produce he has to sell, and telephones his orders to his butcher and grocer. To attempt to estimate the value of the telephone from the standpoint alone of prices and markets is no small task, when one considers the extent to which it is used for this purpose.

The subject of physical connection of all telephone lines and systems, so as to give a universal service, was dealt with by the Ontario Legislature, which passed an Act called "The Ontario Telephone Act, of 1910." All telephone lines and systems, operating in Ontario, are placed under the jurisdiction of the Ontario Railway and Municipal Board. This board has power and authority to effect an interchange of service among all companies, and over

all lines, local and long distance. The Independents have heretofore been opposed to an interchange of traffic on such terms as were offered because they were not fair to us. It is only since the Bell Company was placed under the jurisdiction of the Board of Railway Commissioners for Canada, and all provincial lines under the Ontario Railway and Municipal Board, there has been any prospect of compelling an interchange on a basis fair to both parties.

Universal Connections a Necessity

So long as any arrangement which can be made, remains dependent on the Bell Company's part, it will not prove satisfactory to the Independents. What is desirable is a general ruling from the Dominion Board, covering the points of contention as raised in former agreements with the Bell Company. It will never be possible in this country for one company to operate all the telephones. Therefore physical connection of all lines is absolutely necessary to proper telephone development. The telephone-supporting public demands it and there is no logical reason against. The technical difficulties of physical connection to-day are practically eliminated. All makes of apparatus can be made to work harmoniously together. That one fact removes the only barrier to universal service.

To my mind the only way to get true universal service is to provide for an interchange of traffic among all companies, under proper supervision by the Dominion Railway Commission, or Ontario Municipal Board. A general interchange of local and long distance telephone communication will surely give the public more satisfactory service. The only way to secure such service, enabling the subscriber, from his own telephone, whether Bell or Independent, to talk with all other telephone users, is to obtain a satisfactory general ruling from the above mentioned Boards. Under satisfactory Commission control, unity of system would not mean monopoly of control in any way. Thinking men in the telephone field are seeing more and more the necessity for physical connection of all lines and the economic absurdity of a divided system. However, heretofore, difficulties have prevented a satisfactory and equitable arrangement, but I believe those difficulties can easily be removed by the Dominion Board, or the Ontario Railway and Municipal Board, or both working jointly.

Did you ever stop and consider the subject of adopting automatic car couplers to a wide range of passenger and freight cars made by several different car shops and used by a greater number of railways? At present anybody's car, if it has an automatic coupler, can be hooked onto a train to be hauled by any company or any road in the country, without regard to who made the coupler, or whose car carries it. This condition of affairs has been produced because a number of people, interested in the same problem, came together and settled the essential details. Having reached a settlement, they went their several ways and governed their actions on that basis. Air brakes and car couplers would be nothing like so far along in the progress towards perfection as they are now but for free, full and sometimes very spirited discussion in conference. The transmission of electric power at high pressure, enabling the wealth of the world to be increased by harnessing the water powers; the use of alternating instead of direct current for the lighting of sparsely settled districts; getting together and fighting out the issue has not only enabled a result to be reached earlier than otherwise would have been possible, but has enabled harmonious and mutually beneficial action to be taken and of a kind far better than likely would have been developed by the various interests acting singly. There surely is truth here for the telephone business. Such success as is to come to Independent telephony must come by gathering truth from all its sources, sifting things to the bottom; changing one's mind when one

must. Those who went into the telephone business sanely and wisely, made haste slowly, and solved their problems carefully. We should aspire to perfection. The stability of our investments and the permanence of our cause demand the adoption of standard construction and equipment throughout the Independent telephone field. We are engaged in a fine business. The credit of telephone companies to-day is higher than ever before. They pay their bills more promptly and earn on an average from twenty to twenty-five per cent. of their gross capital annually. Surely ours is a legitimate business and we have a right to stay in the telephone field.

In the face of the feeling of the people at the present time it would be a bold man who would dare stand up and advocate a monopoly in anything. The public is beginning to learn that competition is the most effective way to curb a would-be monopoly; that only while competition exists will a combination of capital keep within reasonable bounds. This is especially true of the telephone business. The Bell Company is not competent to run a local plant as economically as a local company. The purpose of telephone operating, whether Bell or Independent, should in all respects be identical. The methods of operating telephone systems are similar; interests should be mutual and success should be interdependent. Competition is essential; but as relates to the telephone business, the contending factions regard each other as common foes. There are no other public serving institutions that ignore all the sensible and economic devices of co-operation. Banks are public servants. They are competitors. The clearing house is the child of great institutions which vie with each other to get business. One telephone company would not loan a pole to another. Co-operation in all other lines is essential to the highest success. . . . I have watched the game from an angle that tells me there is no hope for either faction of this business unless the bitter warfare ceases. The Bell Company in its practice to annihilate Independents at any cost, will have itself to blame if Independents retaliate. And that Independents will fight to the last ditch is proven by a continuous record of years and years endurance.

Engaged in Legitimate Business

It takes a lot of patience to sit still and wait for things to happen. One of the hardest questions in the telephone business to-day and one which vitally affects our Canadian public, as well as the telephone companies, has been carried before the Dominion Railway Commission by several Independent companies located in various parts of Ontario. The vital point at issue, from the standpoint of the public, is whether the ownership of a limited long distance service can be made the controlling factor through which a monopoly, or partial monopoly, of telephone service may be built up by a group of capitalists largely foreign to the sections in which such control is acquired. The question is, whether a local community must await the convenience of those who control this foreign capital, not only for long distance facilities, but for the benefits of local service which they are themselves willing to provide.

It is an established principle in the laws governing railway operation that the delivery of a commodity in the proper form, and at the proper place, imposes upon the carrier an obligation to forward it to the point upon its line nearest the ultimate destination, and when the destination is not upon its own lines, it must deliver the commodity to a carrier capable of completing the transportation. The Dominion Railway Commission, and also the Ontario Railway and Municipal Board, are primarily bodies created by the public for its protection from abuses which may grow up through the concentration of capital and control of public utilities. It must accomplish such protection,

however, without doing wrong to the property interests represented in the corporations. Exceedingly broad questions of national importance were raised in this complaint made to the Dominion Board and its deliberations were awaited with keen interest in the telephone world, as well as by the telephone using public.

From the decision or ruling rendered it is quite evident that the Dominion Board recognizes that the Independent Companies are engaged in a legitimate undertaking, and while we have succeeded in establishing our standing before the Board, it does not appear as if the Board expected the companies interested to be entirely satisfied with the ruling. Provision is made by the order for a rehearsing of the subject at the expiration of one year if any of the parties interested so desire. The Commission seems to have adopted a cut-and-dried method and depend upon the future for the attainment of an ultimate result.

It therefore rests with the companies who are both directly and indirectly interested in the order, to determine as to what action should be taken, either separately or jointly, in the points at issue. I believe both the Dominion and Ontario Boards are trying to do justly by the telephone interests involved; still the range of human attainment is now so wide and so varied that no man may know it all, and the Boards, as now constituted, must turn to telephone men for their information on questions of telephony and must accept their expert testimony as final. It therefore behooves the companies interested to see that their side in the controversy is well and fully presented. A standard of agreement, as proposed by the Bell, is now before the Dominion and Ontario Boards for ratification. It would be well for this meeting to give this matter due consideration, as well as to take some action to bring before the Ontario Board our ideas as to a standard agreement for connecting Independent companies and systems.

The Draft Agreement

Following the president's address Mr. Gamble opened the discussion on the draft agreement submitted by the Bell Telephone Company. He reviewed the past few years of Independent Telephone progress and congratulated the association on the advances they had made and the fighting spirit they had shown throughout. He referred then to the recent helpful legislation in Ottawa by which they could go to the Dominion Railway Board and insist upon an order connecting any Independent company with the long distance system of the Bell Telephone Company. He doubted if the question of toll had been fairly arranged but this was a difficult matter to arrive at and doubtless at the end of the first year's trial there would be sufficient information for a readjustment of the rates. Mr. Gamble then took up his review of the draft agreement, clause by clause, pointing out where it would be necessary that the committee should be on their guard and make certain changes. A number of the clauses were considered to be quite alright. The matter was left in the hands of the general committee.

Welcomed by the Mayor

The proceedings were pleasantly interrupted by the arrival of Mayor Geary who addressed them for a few moments and expressed his sympathy with the objects of the association. Col. Mayberry, M.P.P., replied on behalf of the association and took occasion to outline his idea of the ideal telephone system for Ontario. Col. Mayberry said, "The ideal system which I believe this association would like to see carried out would be for the Government to assume the trunk lines, allow all local companies to make connection therewith and in that way any subscriber

of one company would be able to get, at a rate fixed by the Government or Commission of the Government, a satisfactory service. This system would be ideal and we hope to accomplish it. To bring this matter more forcibly before the Government is one of the objects of this convention."

Long Distance Bell Connections

The experiences of a number of companies were given on the working out of the trial connection being made for one year with the Bell Company under the ruling of the Dominion Board by which the Independent companies shall have the use of the Bell long distance lines in return for certain payments. Mr. Hoover, of the Markham and Pickering company expressed the opinion that the Bell company was getting much the best of the bargain. The subscribers in his company had not shown any great anxiety for long distance connections and since the arrangement had been in force there had been 191 incoming calls as against 39 outgoing calls. Col. Mayberry also spoke along this line. He felt that his company was doing a good deal of business for the Bell Company and getting nothing for it. Their long distance business had been represented by 175 outgoing calls and 434 incoming calls. This latter part of the service especially was increasing very rapidly. Dr. Gibb, of Blenheim, stated that his company found the arrangement quite satisfactory but that even the Bell agent recognized the fact that the advantage was all to themselves. The Bell company used the Independent system three times as much as the Independents used the Bell lines and while the Bell company was well paid for the service the Independents received nothing.

A number of resolutions were presented and adopted as follows:

(1) "That the agreement, as submitted by the Bell Telephone Company to the Dominion Railway Board, does not meet with the approval of this Committee.

That the Secretary of this Association be instructed to notify the Secretary of the Dominion Railway Board that the Agreement is not satisfactory to this Association, and ask that the hearing be postponed until sometime next year, and that the case be heard in Toronto.

That a Committee be appointed to-day to prepare a counter-agreement, same to be presented to the Dominion Railway Board at the hearing of the case—same to be the result of comparing the best parts of all existing Bell situations and other agreements.

That the members of this Association are asked to assist such appointed Committee in every way, supplying information asked for."

(2) "Whereas it is in the interests of the Independent Telephone Companies and lines that they all get into closer touch with each other, and that to perfect the organization of the Canadian Independent Telephone Association by coming into closer relationship with all Companies.

Therefore be it resolved,—That the executive of this Association take steps to appoint Local District Committees, who shall meet and discuss local conditions in their territory and otherwise promote the interests of the Association with a view to establishing a perfect unity of action in all things pertaining to the welfare of the Independent business as a whole."

(3) "That this Convention, being repre-

sentative of a large portion of the telephone users of the Province of Ontario, respectfully urges upon the Legislature the desirability of providing a Long Distance service which will furnish adequate telephone facilities to all the people without discrimination."

(4) The scale of fees shall be as follows:

Under 50 telephones	\$ 2.50.
51 to 200 telephones	5.00
201 to 300 telephones... ..	10.00
Over 300 telephones	15.00

Two interesting papers were presented during the afternoon, the first by Mr. Hulfish, chief engineer of the Canadian Independent Telephone Company, Limited, on the subject of construction and maintenance of rural systems. Mr. Hulfish confined himself chiefly to telling about the difficulties he had met in the way of line troubles, and how he remedied them. Much of his trouble seemed to come from bad joints in duplex wire. Another interesting article had been prepared by Mr. Wright, of the People's Telephone Company, Sherbrooke, Que. Mr. Wright was unable to be present and his paper was presented by Secretary Dagger. The paper consisted of a short description of Mr. Wright's company, their rates and the difficulties they have had in the way of competition and interconnection with other companies.

Helpful assistance was rendered in the discussion of the various topics throughout the day by the secretary, Mr. Francis Dagger; Mr. W. S. Ormiston, of the Uxbridge & Scott Telephone Company; Mr. F. W. James, of the Welland County Telephone Company; Dr. Gibb, of the Blenheim & South Kent Company; Mr. S. L. Squire, of the Norfolk County Telephone Company; Mr. Moore, of Mount Albert; Mr. M. A. Gee, Erie Telephone Company; Mr. T. G. Ramshaw, Nelson Telephone Company; Mr. M. Banks, Niagara District Telephone Company; Col. T. R. Mayberry, Ingersoll Telephone Company; Mr. A. Hoover, of the Markham & Pickering Telephone Company; Mr. T. G. Shillinglaw, Tuckersmith Municipal Telephone System and many others.

A resolution of condolence on the recent death of the former president of the association, Dr. Demers, was drafted by the secretary.

Readjustment of Charges in Montreal

The application of the Montreal council for a readjustment of the charges of the Bell Telephone Company came before the Railway Commission, sitting in Montreal, but was adjourned at the request of the company, who are having an elaborate inventory made which will not be ready for about another month.

The public is by no means backing up the petition of the city for a reduction in the charges. Instead of getting the many complaints they expected, only about twenty people have come forward, and City Attorney Archambault has expressed the view that, unless the city is better supported, there is little hope of success before the Railway Commissioners. "If the business men of Montreal want us to win some advantage for them they should come forward and show they are interested in the matter. We will do what we can, but I am frankly surprised at the lack of interest taken," said Mr. Archambault. There were many complaints when the company put on \$5 extra for the long distance instrument—now the public is leaving everything to the city. The authorities have gone to a big expenditure in the matter, collecting data from American and European sources, and have also engaged the services of Mr. Francis Dagger, of Toronto.

Telephone Items

The British Columbia Telephone Company has decided to increase its rates for business telephones in both Vancouver and Victoria by \$1 a month.

The Bell Telephone Co. has recently purchased a site in Guelph and will build a new telephone exchange in this city at a cost it is said of about \$40,000.

The North Huron Telephone Co. contemplates big extensions to its line next year and additional equipment will be needed. W. J. Greer, Wingham, president.

The Bell Telephone system in Stratford has been changed over to the central energy type. Up to the present time the old hand ringing system has been in operation.

The British Columbia Telephone Company, Vancouver, has let a contract for a new exchange building at Kamloops, to cost \$25,000. It will be equipped to handle 5,000 services.

At a convention of the union of British Columbia municipalities held recently at Victoria the establishment of municipal telephone systems throughout the province was urged.

Mr. Hugh A. Rose, Toronto, eastern representative of the Canadian Western Lumber Company, Fraser Mills, B.C., has just returned from Montreal, where he secured an order for 35,000 cross arms for the Bell Telephone Company.

It is said that telephone subscribers are being added to the Edmonton exchange at the rate of about 100 a month. The total number of telephone instruments in use in that city is now 3,489. It is probable this department will show a good surplus this year.

An application will be made to the British Columbia Legislature for an act to incorporate the Lake Shore Telephone Co., for constructing, equipping, maintaining and operating a telephone system within and throughout the Okanagan, Yale, Kamloops and Similkameen districts.

Mr. Blain (Peel) has given notice that he will present the following resolution in the Commons: "That in the opinion of this House, wherever a rural telephone system exists or is hereafter established in any rural section of Canada, a telephone should be placed in each post-office in such section by the Post-office Department."

On November 1, 1911, there were 243 rural telephone companies in Saskatchewan. Of these, 101 have been formed since the beginning of the year. There are 6,026 telephones installed in farmers' houses representing 5,717 miles of wire. The government has already added to its system this year 500 miles of long distance wire, 35 new toll offices, 16 new exchanges and has 11 more exchanges under construction.

In March of 1910 action was taken with a view to form a company for the construction and operation of a rural telephone system from Spring Creek, Sask., to Cloverdale and on August 27, 1911, the service was officially opened. The line comprises 35 miles of poles. The president of the company is Mr. W. C. Bruce; vice-president, C. H. Manners; treasurer, Thos. H. Reid; secretary, J. W. Easton; committee, John E. Easton, O. P. Ketcheson. Applications for further extensions have already been received.

Composite Telephone and Telegraph Equipment in its Application to Railroads— Lake Erie Co. has installed it.

The Lake Erie Coal Co., has recently installed a composite telephone and telegraph equipment between Walkerville and Rondeau, a distance of 85 miles, which also has connection with the telegraph circuit along the Pere Marquette Railway. We are indebted to Mr. A. Leslie, general manager of the Lake Erie Coal Co., for the information that this system is giving every satisfaction. The line wire used is No. 8 iron. There are some 10 intermediate telegraph stations but in spite of this neither the telephone nor the telegraph transmission has suffered.

We print below a description of the system as installed by the Lake Erie Coal Co., but inasmuch as it is applicable to a number of similar equipments in different parts of Canada the description is written in general terms.

There are numerous railroads with many branch lines throughout Canada which are equipped at the present time only with wires for telegraph use. In all these instances the advantages of the telephone for train dispatching and message work are probably recognized, but its introduction has been prevented by the necessity of either stringing a new pair of wires for telephone use, or else an additional wire to be used with the one already in use for telegraph purposes. In this latter event, it would have been necessary, in the opinion of many, to have abandoned the use of the telegraph with the introduction of the telephone. However, many roads are loath, and perhaps

with good cause, to abandon, entirely, the use of the first equipment, but it is now possible, by the use of composite sets, to not only retain the operation of the telegraph, but to use the same line for both the telegraph and telephone. This does not entail the stringing of an extra wire and both operations can be carried on over the same line at

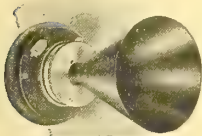


Fig. 1

once, without in any way interfering with each other. Companies with telegraph lines will, we believe, do well to investigate the possibilities the composite set offers for increasing the use of their telegraph lines.

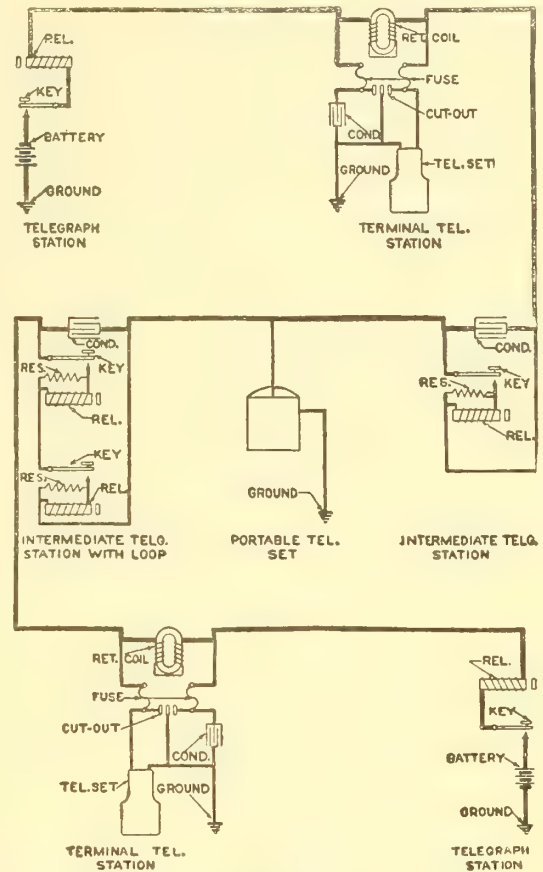
Station Sets.—The wall-type composite telephone set, represents a style commonly used, although both desk and portable sets are available. In appearance the proportions of the former are very much the same as those of central energy wall type sets. In construction both the woodwork, cabling and general assembly are all designed for the rugged service demanded in railroad use.

Signalling.—Signalling is accomplished by a howler, illustrated in Fig. 1, which accompanies each set, and which is operated by an interrupter attached to the end of the induction coil of the set. Code signals may be given with this arrangement similar to the calls with the ordinary ringers. The howler is a type of telephone receiver, equipped with a horn and when signalling current is placed on the line the call given may be made to vary in tone by the adjustment of the howler diaphragm. The ringing current is supplied by a dry cell battery and the operation of calling is, if anything, simpler than on magneto systems, for with composite sets a push button is used for ringing instead of a generator.

General Line Circuits.—It is not practicable to give here a detailed description of the instrument but it suffices to say that on telegraph lines up to 100 miles in length it is possible to carry on telephonic communications with the simple addition of this instrument.

Fig. 2 shows the diagram of a completely composited line. By reference to this circuit, it will be seen that each

telegraph station is bridged by a condenser and resistance to provide a path for telephonic talking and signalling currents, thus evading the high inductance of the relay as well as interruptions caused by telegraph messages. The relay is the path of the low frequency Morse currents, while the condenser and resistance answer the same purpose for the telephonic ones which are characterized by their ex-



SIMPLIFIED ARRANGEMENT OF LINE
RAILWAY COMPOSITE SYSTEM

Fig. 2

tremely rapid variations. The resistance is of low inductance but high resistance and serves as a parallel circuit to the condenser for all currents that may get past this piece of apparatus. A retardation coil at either end of the line prevents the telephone currents passing to earth over the ends of the line. All telephone sets are bridged from line to ground and contain suitable apparatus to prevent any disturbance from the telegraph current impulses. Fig. 3 shows an intermediate station equipped with both telegraph and telephone. The connections and layout are the standard ones employed. In all other respects the circuit is self explanatory.

Portable Sets

Where the telegraph line has been changed to a composite system it often becomes extremely convenient to be able to use a portable set as in the ordinary telephone line. The portable set has almost doubled the elasticity and range of possibility of straight telephone train dispatching systems and the portable composite set here illustrated makes possible the same conditions on systems of this nature. This is shown in Fig. 4. In appearance it is similar to the ordinary portable type telephone. It is equipped with a leather carrying handle and includes a high resistance transmitter and special type bipolar receiver. Both the mounting and design of these parts are such that they occupy the least possible space and at the same time give the most convenience to the user. It is entirely self con-

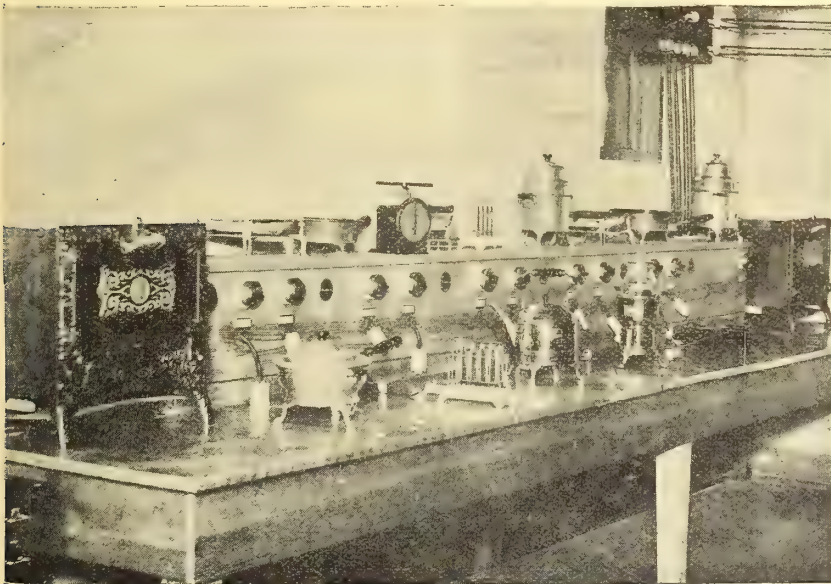
blow torch with its menace as a fire hazard when brought into buildings. The high temperature to which a splice has to be heated in order to solder it injures and lessens the life of the insulation, especially if it be rubber. This bad feature is eliminated by the use of solderless connectors.

At best, a soldered joint is unreliable. Tin, for reasons unknown, often changes its structure and becomes crystalline and in turn affects all other metals that it comes in contact with in a similar manner. This may be the reason why cables often drop out of lugs into which they have been soldered.

Electricity in Domestic Science—Less Expensive to Equip and Operate—Removes Household Drudgery

There is probably no place where electrical equipment should receive a more welcome reception than in household operations, and this is especially true in the kitchen. Having this in view a number of domestic science colleges have recently been equipping their laboratories with modern electrically operated household conveniences and are finding, as a result, a greatly increased interest on the part of students, a decided reduction in the cost of the original equipment, and if anything, a reduction in operating expenses. We have just received a description of the laboratory equipment of the domestic science department in a college in Telluride, a thriving mining town in Colorado and a few items on the results obtained at that point, where a careful and prolonged test has been made of this apparatus, will be of interest.

The kitchen was planned for the accommodation of classes of twenty girls each. The desks were so planned that one 8-inch electric stove would supply heat for two girls working on opposite sides of the desk. Ten of these stoves were thus installed altogether. Each unit was controlled by a switch placed within easy reach. A simple



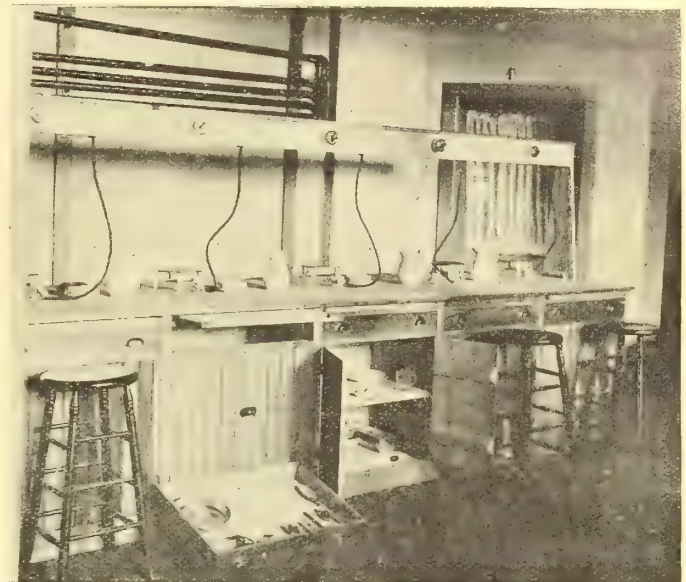
Electrically equipped table for larger operations.

adjustment of this switch to different positions gave the exact amount of heat desired for the work in hand.

To take care of the larger cooking operations a table was installed at one side of the kitchen with larger units similarly controlled to those described above. Either one utensil could be used at a time or all the utensils at once and the heat could be economically regulated. The equipment used on this table consisted of two each of the fol-

lowing: oven, grid, broiler, double boiler, toaster, frying pan; and one each of the following: percolator, chafing dish, waffle iron and flat iron.

A report recently issued by the superintendent of schools for the town, outlines the advantages accruing from the installation of this electrical apparatus as follows: (a)



Ten disc stoves supplied twenty pupils.

The only energy used is that current directly applied to the work done. (b) No utensils are heated except those in use and these only to the degree necessary for the particular kind of cooking being done. There is no waste and it has been shown that money can be saved as compared with the cost of coal for the same work. (c) There is no dirt, no over heated air, no soiled or blackened utensils, no scorched foods. (d) More than all, the girls get interested. The old stove stands in their minds as a symbol of drudgery, and its use recalls hardships incidental to the poorly equipped kitchen. It is not so with the electrical equipment. Everything is convenient, associated with the idea of science, of study, of growth, of improvement. The utensils are attractive, convenient and effective, and the girls approach the work with open minds and study the art and science of home management with pleasure.

The two cuts shown herewith represent two views of the interior of this laboratory.

The report on this installation concludes as follows: "The installation was regarded as a doubtful experiment by many, but the results secured at the end of two years of trying service, have proven that it is the best, the cheapest and the most satisfactory of the available sources of heat. The installation here is a source of genuine pride and satisfaction and were the question of equipment up for consideration now, there would not

be a dissenting voice in the matter of the installation of electrical cooking utensils."

Notice has been given that the Yellowhead Pass Light and Power Company, Vancouver, will apply for a license to use 500 cubic feet of water per second from the Moose River in the Yellowhead Pass in the Cariboo water district. The water is to be used for power purposes.

Industrial Progress and Trade Notes

Trade Publications

Resistance Units.—Bulletin 1106, issued by the Wirt Electric Specialty Co., of Germantown, Penn., descriptive of their Di-el-ite resistance units.

Mathematical and Drawing Instruments.—A new circular by Keuffel and Esser Co., Hoboken, N.J., cataloguing, with prices, their instruments and drawing supplies.

Import Catalogue, issued by Max Schaffer Co., New York City, describing their importations of prisms, pendants, chains, fringes, tube hangers, gas globes, inverted shades, &c.

The Holiday Gift, an attractive little booklet issued by the Canadian General Electric Company, illustrating and describing a number of useful and attractive electric holiday gifts.

Chandelier Chains.—Catalogue issued by W. H. Banfield & Sons, 120 Adelaide street west, Toronto, describing and illustrating their 150 different designs of brass and steel chain for electric fixtures suspension.

Daylight Lamp.—A pamphlet issued by the Volkmer Electrical Co., Hudson street, New York, descriptive of their high efficiency arc lamp. An installation of these lamps has recently been made in Edmonton, Alta.

Opalux.—A booklet issued at the Canadian General Electric Company, describing, with illustrations, the wide, medium and narrow gauge Opalux reflectors. Curves are also shown illustrating protometric tests which show the distribution of light from these shades.

Ornamental Street Lighting.—Two booklets entitled "Ornamental Street Lighting, a Luxurious Necessity," and "Jandus Luxolabra, for the City Beautiful," issued by the Adams-Bagnall Electric Company, through their Toronto agent, Mr. A. Ross Osborne, Continental Life Building.

Telephone Supplies, Bulletin No. 1003, issued by the Stromberg-Carlson Telephone Company, descriptive of telephone supplies and telephone construction material. This is a book of over 200 pages, including nearly all the standard material used by telephone companies. Well illustrated and handily indexed.

Alternating Current Water-Wheel Generators,—Circular No. 1198 issued by the railway and lighting department of the Westinghouse Electric and Manufacturing Co., descriptive of their different types of generator, both vertical and horizontal, for water-wheel drive. A number of actual installations are illustrated.

Naugatuck Malleable Iron Co., manufacturers of insulator pins, brackets and brake arms for electric railway, electric lighting, telegraph, and telephone service, have issued a little booklet descriptive of these specialties which is being distributed through their Canadian agent, Mr. Irving Smith, 406 St. Nicholas Building, Montreal.

Tips for Trips.—An illustrated and informing bulletin issued by the B. C. Electric Railway Company, descriptive of their Fraser Valley line. One of the illustrations shows a three-coach train operated by the multiple unit system. The complete track system of the company, also their generating stations, sub-stations and transmission lines are shown on a map.

Condensite,—An insulating material prepared in many forms and which can be adapted for impregnating electric apparatus, being applied as a varnish. For insulating parts of apparatus in electro-plating or similar processes it is valuable, not being affected by chemicals and it is said

that the chemicals will not creep over this material. An explanatory pamphlet is issued by the Condensite Co. of America, Glen Ridge, New Jersey.

Glover's Cables,—Descriptive catalogue (mains section), and price list, of cables for electric lighting, power and traction purposes, manufactured by W. T. Glover & Co., Manchester, England. The book is divided into three subsections, (a) "diatrine" paper lead covered cables; (b) "diatrine" paper leadless cables; (c) "bitumen" insulated cables. The catalogue is illustrated in colors and complete specifications of the cables are given showing the various sizes, weights, prices and so on. 280 pages, stiff covers.

Watt-hour Meters,—Bulletin No. 120, issued by the Packard Electric Co., Ltd., St. Catharines, descriptive of their type K. watt-hour meters. The bulletin is profusely illustrated and each part is minutely described. The internal connections and wiring arrangements are also very fully explained. Finally a series of diagrams is shown indicating the proper method of connecting up these meters under the different conditions which may arise. An important feature about these wattmeters is the almost negligible error in reading due to wide variation in voltage. An actual test, on a meter picked at random from stock, showed an error of less than 1-3 of one per cent. for a voltage variation between 80 per cent. and 120 per cent. of normal.

New Books

Gas Engine Troubles and Installation.—by J. B. Rathbun, B.S., C.E. The Charles C. Thompson Co., Chicago, publishers. A book that shows you how to install, operate, repair and keep gas engines running. 450 pages of well illustrated and instructive matter.

Westinghouse Air Brake System.—Frederic J. Drake & Company, Chicago, publishers: containing detailed description and explanations of all the various parts of the Westinghouse air brake, including the 8½-inch cross compound air pump; No. 6-E T equipment; high pressure control, schedule U; the K triple, L triple and L N triple equipment; combined automatic and straight air brake; and the 1¼-inch pump governor. The book also contains a complete course of catechetical instruction on all matters pertaining to the construction, care and operation of the modern air brake.

Walker's Loose-Leaf Pocket-Book, by Norman P. Corke, A.M.I.E.E. Hughes Owens Co., Ltd., Montreal, publishers. A Canadian edition of this book has just been completed containing varied statistical information for engineers of all classes. This work is also published in German and French; also English and United States editions are obtainable, especially applicable to conditions in those countries. The information contained in this work will be found very useful by anyone who requires a mass of detailed information always at close range.

New York Air Brake System.—Frederic J. Drake & Company Chicago, publishers; compiled and edited by the world's leading air brake experts. A complete and strictly up-to-date treatise containing detailed descriptions and explanations of all the various parts of the New York air brake, including the Duplex air pump; Engineer's Brake valves; B-3 equipment; Accelerator valve; L Automatic brake valve; Duplex and Triplex Pump Governors; the J Triple, K Triple and Quick action Triple. Automatic brake valve, automatic control. The book contains also a com-

plete course of catechetical instruction on all matters connected with the construction, care and operation of the modern air brake. Well illustrated with numerous colored charts.

The Copper Handbook.—Horace J. Stevens, compiler and publisher, Houghton, Mich.; price \$5, or \$7.50, according to binding. A manual of the copper industry of the world covering in a most comprehensive way the history, geology, chemistry, mineralogy and mining of copper. The copper deposits of the different countries of the world each receive one chapter. A separate chapter is also given to each of the following: milling and concentrating, hydrometallurgy, pyrometallurgy, electrometallurgy, alloys, brands and grades, uses, substitutes, glossary of mining terms, copper mines of the world and general statistics. The book comprises some 2,000 pages. The publisher states that he will send this book prepaid, without advanced payment, on one week's approval to anyone ordering it.

Hydro-Electric Plant at the British Aluminum Company's Factory, Kinlochleven

Two papers recently read before the Institute of Civil Engineers describe the hydraulic and electrical features respectively of the hydro-electric plant of the British Aluminum Company's factory in Scotland. The development scheme possesses a number of advantages including a large catchment-area, heavy rainfall and high head. The catchment-area is 55 sq. miles in extent. The rainfall ranges from 70 to 80 inches and there is a maximum head from the top of the dam of 1,068 feet above the tail-race.

Water is conveyed by a $3\frac{1}{2}$ -mile conduit of square section 8 feet by 8 feet and laid to a general gradient of 1 in 1,000. The construction is a concrete lined rock excavation. Where the work is above rock level the concrete is reinforced with expanded metal and round bars and expansion joints are inserted in the walls every 64 feet. Contraction cracks at first appeared between these joints but disappeared when the water was let into the conduit. The conduit discharges into a penstock chamber of about 300,000 gallons capacity.

From the penstock chamber water is conveyed to the power house in 6 welded steel pipes, 39 inch diameter, $1\frac{1}{4}$ miles in length, giving an effective fall of 935 feet. The pipes are supported upon concrete pedestals with heavy concrete anchorages at the bends. The pipes are made from one plate welded longitudinally and vary in thicknesses from one centimeter to 2.2 centimeters. Water is distributed from the main pipes by a system of 2 omnibus pipes and 6 feeders.

The total generator capacity installed is 30,660 h.p. This includes 9 main units and two exciter units. Each unit comprises one turbine and two generators. The turbines are Pelton-wheel type with two water jets. All the connections within the generating station are made of bare aluminum strip. The feeders and distributors for lighting and power in the village and on the wharves are also made of bare stranded aluminum cables carried on wooden poles. The turbines are Escher-Wyss manufacture and the dynamos Dick, Kerr & Company.

The Largest Turbine

On November 3 what is claimed to be the largest turbine in the world was placed in service by the New York Edison Co., and is described in "Power" as follows:

The machine is of the Curtis vertical type having a rated capacity of 20,000 kw. or nearly 27,000 h.p. It is now carrying the load of 7 vertical reciprocating engines any one of which occupied nearly as much space as the new machine. The new turbine stands 35 ft. 7 in. high, is

17 ft. in diameter and weighs 420 tons. The generator driven by this turbine is of the 4-pole type, 750 r.p.m., 6600 volts, 25 cycles. The steam consumption of the turbine, with steam at 175 lbs. gauge and 100° superheat, and a $28\frac{1}{2}$ -inch vacuum, varies from 150,000 to 300,000 lbs. per hr. for a load varying from 10,000 to 20,000 kw. This works out to about 15 lbs. of steam per kw.h. It is estimated that about 86,000,000 gals. of condensing water will be required per day when operating under full load. The generator is cooled by an air draught carrying 80,000 cu. ft. of air per minute. It is planned to install two more similar units.

Mr. Pierce Joins Canadian Carbon Company

Mr. Milton S. Pierce, district manager of the Northern Electric & Manufacturing Company, has acquired an interest in and becomes vice-president of the Canadian Carbon Company, Limited, dating from January 1st, 1912, thus necessitating his resignation from the telephone business. Mr. Pierce started with the Northern Electric Company 14 years ago, and has worked up through the various departments to the position of district manager, which he has held for three years. His business ability, thorough training and cordial manner have made him many friends whose good wishes will follow him in his new work. The selling end of the Canadian Carbon Company will be in Mr. Pierce's charge, while the manufacturing and purchasing end will be looked after by the president, Mr. Alfred Landau.



Mr. M. S. Pierce

Brass and Steel Chandelier Chains

W. H. Banfield & Sons, the largest manufacturers in Canada of brass and steel chandelier chains, report a large expansion in their business orders. This firm do their own brass plating and brush brass finishing in their factory at 120 Adelaide street west, Toronto. A special feature of their shipping arrangements is that they manufacture and ship their chains in yard lengths either finished or unfinished and all chain is wrapped in tissue paper to prevent scratching. A large stock is carried at the above address insuring prompt shipments. This company is distributing an attractive 1912 calendar, also a catalogue illustrating their complete range of some 150 different designs of brass and steel chains, with full size cuts.

The Madison Williams Company, turbine manufacturers, Lindsay, Ont., have just filled a contract for the supply of one of their 'Triumph' turbines in connection with the Streetsville water works system.

A new company under the firm name of Roper, Clarke & Company, Limited, with head office in Montreal, and a capital of \$40,000, has been incorporated to deal in machinery, tools and electrical, mining and contractors' supplies.

Laurie & Lamb, engineers, Montreal and Vancouver, have issued a pamphlet describing work they have completed or that is still in progress by this firm. The items include installations of air compressors, refuse destructors, steam disinfectors and filtration systems.

An Efficient Isolated Plant

The accompanying illustration shows the interior of the small private plant of the Marshall Shoe and Leather Company, Hamilton, Ont. The equipment consists of a 15½ h.p. Keighley gas engine connected as shown to a 7½ kw. Toronto and Hamilton Electric Co. d.c. generator. The gas engine operates on either natural or manufactured



Gas-Engine Driven Private Electric Plant, Hamilton.

gas as desired but for the most part natural gas is used. During the day time the engine operates the factory machinery, the generator not running, but during the afternoon and evening the generator is operated for factory lighting.

The general manager of the company states that he is well pleased with the operating-cost account of his isolated plant and figures that with gas at 40c. per thousand feet allowing 6 per cent. interest on investment and 10 per cent. depreciation on the plant, he can run his factory and generate his own electricity for one-half of what it can be bought from any outside source.

A.-C. Co. Take Half-million Contract

A contract, involving approximately \$500,000, for the entire mechanical equipment for a sawmill and lumbering plant to be erected on the Island of Formosa by the Japanese Government, has been awarded to Allis-Chalmers Company, Milwaukee. The contract is for motor driven apparatus throughout, and includes steam turbines,

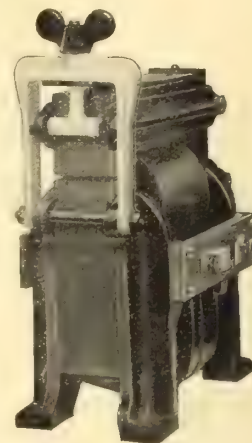
The plant of The Flexible Conduit Company, Limited, Guelph, is reported to be running full force night and day.

Unique Postal Card Booklet

The Kellogg Switchboard & Supply Company, Chicago, are issuing a unique postal card booklet, with factory and branch office views and giving the personnel of the sales representatives. This little booklet, attractively printed in two colors, is a part of an ordinary mailing card.

Flexible Transformer

The transformer illustrated herewith, representing a design recently placed on the market by the Thordarson Electric Manufacturing Co., is constructed with a magnetic shunt and equipped with a regulating device designed to give instant adjustment. These transformers are suitable for wireless work, ozone generation, insulation testing and so on. Two types are manufactured, type H-1 regulating from 1 to 7 amperes and with an approximate voltage output of 10,000 and type H-2 regulating from 2½ to 9 amperes and with a transformer voltage output of 20,000.



Resident Engineer for W. H. Allen, Son & Co.

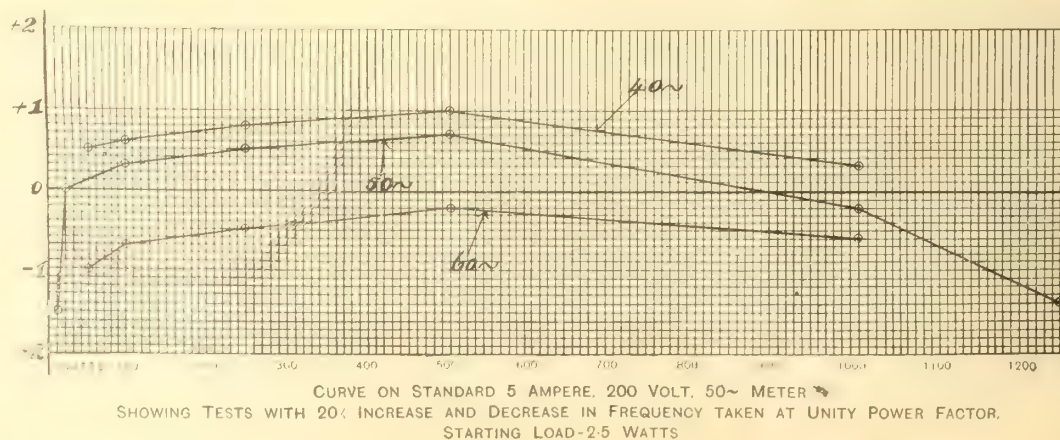
It is announced that Mr. A. L. Mieville, late assistant engineer, power construction department, city of Winnipeg, will take up his residence permanently in Toronto as engineer in Canada for the firm of Messrs. W. H. Allen Son & Company, of Bedford, England. This firm manufactures high speed steam engines, condensing plants, steam and water turbines, all types of centrifugal pumps and fans, and direct current electrical apparatus. The Toronto office will be with Chapman & Walker, 69 Victoria street, Toronto. Mr. Mieville is an associate member of the Canadian Society of Civil Engineers, associate member of the Institute of Mechanical Engineers and has had wide experience in engineering work with some of the largest firms in England, Canada and the United States.

The Lake Superior Paper Company, Sault Ste. Marie, have awarded a contract for the supply of some fifty electric motors to Chapman & Walker, Limited, of Toronto. These motors, approximating a total of 3,000 h.p., will be used in operating paper manufacturing machinery.

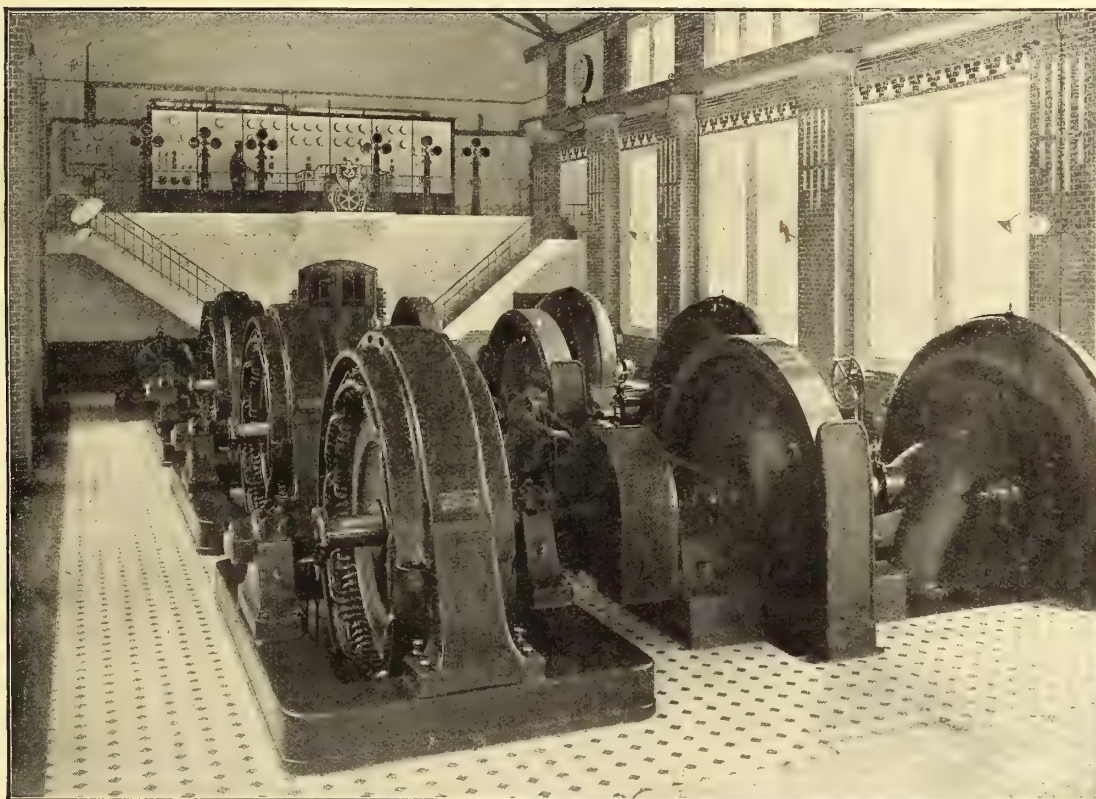
Notice is given of the incorporation of the Flanders Electrical Vehicles Company of Canada, Limited, with head office in Walkerville, Ont. The object of the company is to manufacture, operate and deal in vehicles, including automobiles, boats and vessels, operating or controlled by electricity, gasoline, naphtha, or similar agents.

Accurate Watt-Meters

The accompanying curves indicate the results of tests on Chamberlain & Hookham's alternating current watt-hour meter. This meter was designed for 50 cycles, but it will be seen that very little inaccuracy is shown when the periodicity is changed to as low as 40 or as high as 60. The starting load required for this instrument is only 2½ watts.



SIEMENS



3 of 5 Siemens Horizontal Water Wheel type Generators each 715 h.p.

The Siemens Companies manufacture horizontal and vertical water wheel generators and have a great number of both types in successful operation in all parts of the world with outputs up to 16,000 h.p. and pressures up to 20,000 Volts. More than 50 machines with terminal pressure of 10,000 Volts and over have been constructed.

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Current News and Notes

Baden, Ont.

This is the birth place of the Hon. Adam Beck, the champion of Niagara power for the towns of Western Ontario. A monster celebration is in course of preparation and a banquet will be tendered Mr. Beck on the occasion of the turning on of hydro-electric power here on December 29th.

Bassano, Alta.

It is said that the electric railway connecting Bassano with the C. P. R. irrigation dam some five miles distant will be commenced immediately and rushed to completion within ninety days. A franchise has been granted to the Bassano Electric Power and Traction Co. It is said gasoline-electric cars will be used.

Berlin, Ont.

The Berlin Street Railway System is reported to show a profit for the year of \$4,500. The traffic for November was unusually large, 17,000 more people being carried than a year ago.

Calgary, Alta.

Estimates have been prepared for city lighting extensions aggregating \$175,000.

Campbellton, N. B.

The Board of Trade is endorsing the action of the controllers in their efforts to have all electric wires placed under ground.

Chatham, Ont.

It is planned to replace a large number of the old arc lamps early next year with a more modern type.

The industrial committee are planning the erection of electric signs at the Grand Trunk and Canadian Pacific depots as an advertising scheme.

Chicoutimi, P. Q.

The Chicoutimi Water & Supply Co., Chicoutimi, P. Q., have placed an order in accordance with the plans and specifications of their consulting engineer, Mr. H. S. Ferguson, 200 Fifth avenue, New York City, for two steel penstocks, with the Petroleum Iron Works Co., New York City. These penstocks will be 10 ft. in diameter, 400 ft. long, and $\frac{3}{8}$ inch thick. Because of the cold weather, work upon the superstructure of the plant will be suspended until spring.

Collingwood, Ont.

There is some agitation for an electric line connecting this town with outlying villages.

Edmunston, N. B.

On December 13th this town inaugurated its new electric light plant. The generating station of both the water and the electric plant combines a capacity of 750 h.p. It is situated on Green River, ten miles north of Edmunston and consists of a dam 400 feet long and 28 feet high, the power house containing two units of twin water-wheels direct connected to two generators. The streets of the town are now lighted with 150 80-watt tungsten lamps. The

water can be pumped either by a steam pump or an electric centrifugal pump having respectively a capacity of 700 and 1,200 gals. per minute.

Edmonton, Alta.

When the new 2,000 turbo-generator is installed there will be plenty of alternating current, but not sufficient direct current for street railway purposes. It has been recommended by Railway Superintendent Knight that a rotary converter be installed immediately.

The charter of the Edmonton Inter-urban Railway Co., which called for the construction of 400 or 500 miles of sub-urban railway lines radiating out from Edmonton, has been taken over by an English corporation and it is said construction will be commenced in a short time.

Following the surplus shown by the lighting department under the management of Superintendent Ormsby it has been decided to make a reduction to the consumer in the form of the removal of the usual meter charge. This amounts to 25 cents a month and is equivalent, it is calculated, to a ten per cent. reduction for the average consumer.

A bill authorizing the South East Calgary Electric Company to construct an electric line to a point at or near Shepard is under discussion. By the provisions of the bill the company has no rights on any of the streets of Calgary except with the consent of the city. Capitalization is placed at \$250,000. Work is to commence within two years and finish within five. Permission is asked to generate and distribute electric energy for power and light purposes.

Fernie, B. C.

The plant of the Bull River Power Company, on which considerable construction work has been done, has been taken over by a syndicate including Messrs. M. A. Devitt and H. W. McCoy. It is announced that the company will build a duplicate transmission line on steel towers direct to Fernie and continue it on through the Crow's Nest Pass to Frank. The original plans were for an immediate development of 10,000 h.p., and these plans will probably be adhered to.

Forest, Ont.

A by-law will shortly be submitted to purchase the electric light plant and carry it on as a municipal undertaking.

Fredericton, N. B.

It is said that interested persons have been looking over the ground here with a view to constructing and operating a street railway system.

Galt, Ont.

In order to assist in the illumination of the streets the citizens will be given a flat rate of 10 cents a month for a 25-watt tungsten lamp which will be installed on the verandah and burn all night.

Goderich, Ont.

The Ontario Hydro-electric Power Commission now propose to develop

two or three water powers in this district which will have a total high water capacity of from 12,000 to 15,000 h.p., and a minimum of 3,000 or 4,000 h.p.

Guelph, Ont.

The street railway extension in the St. Patrick's Ward has been completed and is in operation.

Hamilton, Ont.

Tenders will be received until January 9th for an electric pumping equipment for the Wentworth sewage disposal plant.

The contract for the sub-station in connection with the installation of the hydro-electric distribution has been let to G. F. Webb, and work has begun.

It is said the Dominion Power and Transmission Company are making arrangements to supply electrically lighted business signs along the main streets.

It is now said that the International Bond & Share Company, New York, will finance Mr. John Patterson's proposition concerning the Hamilton, Waterloo and Guelph electric railway and that active construction will be begun next spring.

Innisfail, Alta.

Mr. Maxwell has been retained as consulting and supervising engineer in connection with the installation of an electric lighting equipment for the town. Work will not be commenced until the spring on account of the extreme early cold in the West.

Kincardine, Ont.

The light commission is taking up the matter of extending the lighting system. Dr. Armitage, chairman.

Lacombe, Alta.

The Lacombe electric light department is showing a profit and it is expected the price of light to the consumers may be lowered.

Lethbridge, Alta.

A by-law to expend \$450,000 was recently passed by the citizens, \$300,000 of this to be expended on a street railway system, the remaining \$150,000 on necessary extensions to the power plant. Following this vote the contracts have been let for a steam turbo-generator to Willans & Robinson, for a steam-driven exciter to the same company, for boilers to Babcock & Wilcox, for economizers to the Green Fuel Economizer Co., and for sub-station equipment to Siemens Bros. Superintendent Arthur Reid is in charge of the equipment.

London, Ont.

The commissioners will extend the street lighting system and about 500 lights will be added next year. Superintendent Glaubitz will have charge of the work.

The proposal to dam the Aux Sables River at Rock Glen is meeting with opposition in the neighborhood as it is said the farming district will be affected for 20 miles back.

The Board of Trade is actively supporting the by-law for granting a bonus of \$25,000 to the North Midland Rail-

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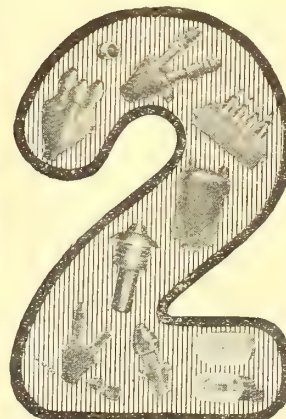
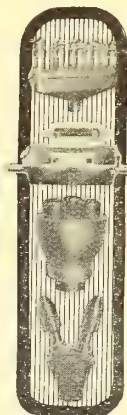
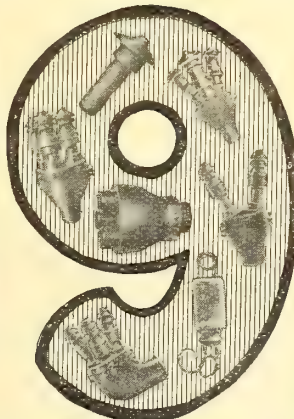
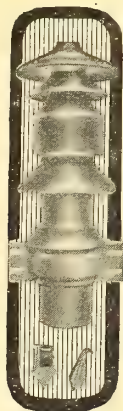
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G & W Electric Specialty Company, Chicago 6408 Jackson Park Avenue

way. This sum would be used to assist in providing a terminal station for all radials coming into the city.

The London and Lake Erie Transportation Company has decided to purchase four new electric cars.

There is some talk of the London and Port Stanley Railway, now operated by steam, being ultimately equipped for electric operation. This would not be until 1914, when the lease of this road to the Pere Marquette expires.

Medicine Hat, Alta.

The new electric light rates have been fixed as follows: residences 8c. per kw.h., instead of the old rate of 10c.; commercial and business houses 6c. per kw.h., replacing the old rate of 8c.

Mimico, Ont.

The Interurban Electric Co. has announced that it will give its customers in New Toronto and Mimico the same rate as it is now giving in the city of Toronto. This rate compares favorably with the rates given by this company's competitors.

Moose Jaw, Sask.

For the first ten months of the present year the electric light department under the operation of the municipality has made a net surplus of over \$8,000. This is in the face of a reduction in rates on January 1st of this year from 14c. to 9c. per kw.h., and suggests the probability of a further reduction with the coming year.

Montreal, Que.

It is officially announced by the Canadian Pacific Railway Company that anywhere from 1,000 to 1,500 more miles of telephone train dispatching will be put in operation during 1912.

City Attorney Archambault's complaint that the citizens were not availing themselves of the opportunity of registering a protest against the Bell Telephone rates in this city has resulted in a large number of communications being sent in on this subject.

Nelson, B. C.

\$500 was voted by council to be expended on a number of street light transformers.

Niagara Falls, Ont.

Mr. W. J. Laughlin, Welland, is negotiating with the Council for a franchise to run a line through Bridgeburg connecting Port Colborne with Niagara Falls.

North Toronto, Ont.

It is reported that a franchise is being asked by a company to build and operate a trolley service here. The idea is to connect with the present proposed Rosedale extensions, run north through the new cemetery road, west across Yonge street and south to the city lines on St. Clair avenue.

Orillia, Ont.

A change in the telephone system is contemplated here from the manual to the central energy type.

Oshawa, Ont.

A by-law is being submitted to confirm an agreement between the Oshawa Electric Light Company and the municipal corporation of the town. A ten-year franchise is being given the company.

Ottawa, Ont.

The power house of the Ottawa Electric Company was recently damaged by fire.

It is said the Ottawa Light, Heat & Power Company will add considerably to their auxiliary steam plant.

The Dominion Government has granted leases to the Ontario Provincial Government of dams No. 4 and 8 on the Trent Canal. Dam No. 4 will develop about 3,000 h.p., dam No. 8 approximately 5,000 h.p.

The International Brotherhood of Electrical Workers has petitioned the council for a by-law compelling all tradesmen in the electrical line to pass certain examinations before securing a license to work.

The newly annexed sections of this city will have much improved lighting systems in the near future. The Ottawa Electric Company will supply the power at the rate of \$15 per 100 watt tungsten lamp per annum.

Another power company under the name Eastern Canada Power Company, Limited, has been incorporated at Montreal to carry on an electric light and power supply business. The company is capitalized at \$1,000,000.

Paris, Ont.

A by-law will be submitted on the question of receiving power from the Hydro-electric Power Commission. An estimate of \$13,000 to install the system in this town has been submitted by the Commission's engineers.

Peterborough, Ont.

Proposals to light the streets by the ornamental standard system are being discussed. It is understood that the Peterborough Light and Power Company have offered generous terms.

The Otonabee Power Co. was recently taken over by the Electric Power Co., the private corporation operating a number of water powers along the Trent River. The Hon. Adam Beck and a number of interested persons have recently been in Ottawa discussing with the government the question of expropriation of the Otonabee plant for operation by the Hydro-electric Power Commission.

Pincher Creek, Alta.

The hope that electric rates under the municipal system would be reduced in this town have not been realized. For household purposes the charge is still 17½c. per kw.h.

Port Arthur, Ont.

The down-town installation of street lights is being rapidly pushed forward. Along Cumberland and Arthur streets, the lights are in groups of four and on the less important streets in groups of two. The same poles which carry the light and telephone wires have been used also for the street lighting brackets. The lights are placed ten feet from the ground, it being found that in this position better general illumination is obtained. Lamps are placed on every pole along the main streets.

Port Credit, Ont.

A by-law calling for the expenditure of \$7,500 to cover the cost of a distribution system will be submitted to the ratepayers on January 1st.

Port Dalhousie, Ont.

This town has been supplied with light from the private power plant of the Maple Leaf Rubber Company. The franchise has expired, however, and unless it is renewed on January 1st the company states that they will not continue in the lighting business any longer.

Prince Albert, Sask.

The actual location of the dam at La Colle Falls has not been fixed owing to the difficulty of locating a suitable foundation in the river bed. Engineer C. H. Mitchell has been making further investigations.

Quebec, Que.

It is said the Lake Megantic Pulp Co. will build a dam on the Chaudiere River and install turbines up to a capacity of 1,500 h.p.

Regina, Sask.

Objections have been raised to the cost of the municipal street railway. It is said that \$60,000 too much has already been used in this work.

Rossland, B. C.

It is said the Westinghouse Company are making a report on the question of electrifying a part of the C. P. R. road in this district.

Rouleau, Sask.

The by-law to raise \$15,000 to complete the electric light system was carried.

Sarnia, Ont.

Owing to a recent accident to part of the machinery the customers of the Sarnia Gas and Electric Light Company were requested to co-operate with the company in using as little current as possible at peak load hours.

Saskatoon, Sask.

It is expected that the new generator will be in operation some time during January.

Anticipating the arrival of an abundance of power when the hydro-electric plant on the Saskatchewan River shall be completed the Board of Trade of this city has already determined to advertise the power benefits to be obtained here and will take steps to obtain consumers ready for the power the moment it reaches the city.

Sault Ste. Marie, Mich.

At a recent meeting of the Council of the Board of Trade it was decided to initiate steps to secure the municipal control of public utilities at the earliest possible date. This programme will include the taking over of the electric light and waterworks plant from the Tagona Water and Light Company, whose franchise expires in 1914.

Seaforth, Ont.

Domestic and commercial and street lighting from the Hydro-electric Power Commission's system were inaugurated in this town on December 1st.

Sherbrooke, Que.

It is said the People's Telephone Company, of this place, and the Bell Telephone Company, will amalgamate.

St. John, N. B.

It is said that A. R. Gould, of the Maine and New Brunswick Railway Co., will likely be awarded the contract for

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A Full Line of Alternating Current Switchboard Indicating Instruments

is offered by this Company, comprising:

**WATTMETERS, Single and Polyphase.
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This whole group of instruments embodies the results of several years exhaustive study and scientific investigation of all the complex electrical and mechanical problems involved in the development of durable, reliable, sensitive and accurate instruments for use on alternating current circuits.

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We invite the most critical examination of every detail of each member of the group. We also solicit the fullest investigation of the many other novel features and very valuable operative characteristics of these new instruments and request a careful comparison in all these respects with any other make of instrument intended for like service. We offer them as a valuable and permanent contribution to the art of electrical measurement. Their performance in service, will be found to justify the claim that no other makes of instruments approach them in fitness for the service required from A.C. Switchboard indicating instruments.

Full particulars of design, construction, prices etc., are given in Catalogue C.E. 16. Write for it.

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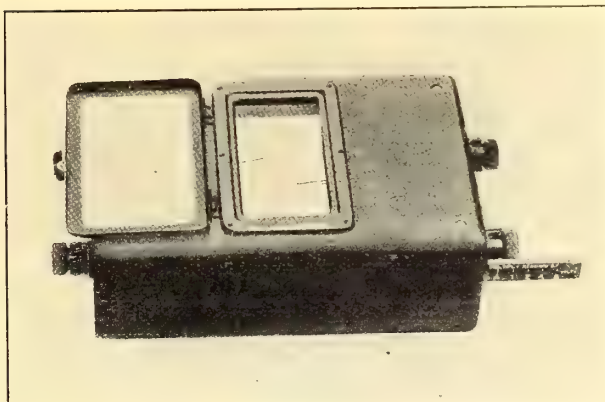
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Meggers, Bridge Meggers, etc.

the construction of the St. John Valley Railroad.

The Provincial Legislature has been asked to ratify an agreement between St. John city council and the New Brunswick Hydro-electric Company. The agreement mentions maximum rates for power and light. The company proposes to generate power on the Lepreaux River. It is understood the agreement does not constitute an exclusive franchise.

St. Mary's, Ont.

The Light Commission has fixed the price of the all night arc lights used on the streets at \$65 per annum.

St. Thomas, Ont.

The City Council has referred to a committee for consideration the suggestion to extend the city's street car line to Aylmer, twelve miles west.

Strathcona, Alta.

It is probable extensions involving some \$400,000 will be made to the street railway system of this town during 1912.

Thamesford, Ont.

This village has signed a contract for hydro-electric power and it is expected the work of installation of the line will soon be commenced.

Thorndale, Ont.

The East Middlesex Telephone Company will make important extensions to its system, including a line to Evelyn T. Berger, manager, Thorndale.

Thorold, Ont.

An amicable agreement has been reached between the town of Thorold and the Niagara, St. Catharines and Toronto Railway Company, whereby the franchise has been renewed and the railway service resumed.

Toronto, Ont.

The rate-payers are being asked to vote \$139,000 for extension of car lines on Danforth road.

A by-law asking for the sum of \$2,200,000 for extending the city distribution system will be submitted at the January elections.

The two hydro-electric transforming stations situated in the northern part of the city are now practically complete and will be put into operation not later than January 1st.

It is reported that the Quebec Government have under consideration the appointment of a Hydro-electric Power Commission with powers similar to those of the Commission in Ontario.

K. J. Dunstan, manager of the Bell Telephone Company, of Toronto, has intimated that it will be necessary to divide the "College" exchange into two sections in the near future. This will necessitate another building.

The following municipalities will vote on the question of closing an agreement with the Hydro-electric Power Commission for the supply of electric energy: Peterborough, Kingston, Prescott, and Lakefield, Hagersville, Caledonia, Port Credit, Cayuga and Paris, Wiarton, Paisley, Kincardine, Owen Sound, Collingwood, Thornbury, Listowel, Exeter, Brussels, Hensall, Blythe, Bayfield, Clinton, Goderich, Lucan, Ailsa Craig and Wingham.

Vancouver, B. C.

The current issue of the B. C. Gazette gives notice of the intention of a com-

pany to apply at the coming session of the Legislature for an act of incorporation empowering them to construct and operate a line of underground tramways with a radius of 7 miles from the corner of Hastings and Main streets.

Welland, Ont.

It is said that C. J. Laughlin, representing the Street Railway Company, has offered the town the use of its steel poles for the purpose of lighting the main streets with tungsten cluster lights.

Winnipeg, Man.

The city council has definitely fixed the price of light and power in the municipal plant at 3c. per kw.h. The private company has intimated its intention of meeting this rate.

Enquiry has been received from Portage la Prairie, asking the rates and terms on which this city would sell power to Portage. About 3,000 h.p. could be taken and a rate of \$30 has been suggested.

Woodstock, Ont.

A by-law to expend \$10,000 on the installation of an improved lighting system will be submitted at the January elections.

P PROCURED IN ALL
COUNTRIES
LONG EXPERIENCE
IN PATENT LITIGATION

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RIDOUT & MAYBEE
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Advertisers who wish to conceal their identity may do so by using an Electrical News box number without extra charge.	
Forms close on the 18th of each month.	

Situations Wanted

Advertising Manager—Of a large manufacturing concern of Cleveland, Ohio, desires to connect with a going house, who are looking for results in advertising. Is competent of writing own copy, compiling of catalogues, folders, circulars, etc. For further information address Box 386, Electrical News, Toronto, Ont. 1-2

Municipal Electrical Superintendent with 12 years' American and Canadian technical and practical experience in up-to-date methods of plant maintenance and operation, transmission, line construction, high or low tension, distribution of services, installation of meters, motors, and other modern power appliances, arc or incandescent street lighting systems, desires change to a growing town or small city; can produce results; married, age 36 years, Graduate S. C. S. West preferred. All references. Box 392, Electrical News, Toronto, Ont.

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Telephone Maintenance Men

for large private telephone system (12 exchanges), operating in connection with power transmission lines. Applicants must have a good education, must be thoroughly experienced in locating trouble in switchboards and instruments, and capable of keeping apparatus in perfect order and repair. Steady position and good opportunity for a thorough and reliable man. Address Hydro-Electric Power Commission, Toronto, Ont. 1-1

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Sales Agents Wanted

Large British firm with plants in England, Bohemia and France, manufacturing Carborundum and Electrite Goods and high class grinding machinery, wants to secure either first class salesmen or firms with established trade connections to represent them in Canada. Apply Box 395, Electrical News, Toronto, Ont. 1-2

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For the technical staff of some of our foreign representatives we require as soon as possible a number of trained engineers. Please apply to us stating conditions, experience and references. Applicants should be unmarried and not more than 30 years of age. Applicants should possess:

A thorough theoretical and practical knowledge of electrical machinery and apparatus and their erection.

and should have been engaged in the business at least 5 years, should speak at least two foreign languages fluently and have had some business training in the country for which he desires employment.

Applicants must agree to a 3 to 6 months apprenticeship course at our works before being sent out to respective countries. This is a good opening for the right men.

Allmanna Svenska Elektriska Aktiebolaget,
Foreign Department
Vasteras, Sweden.

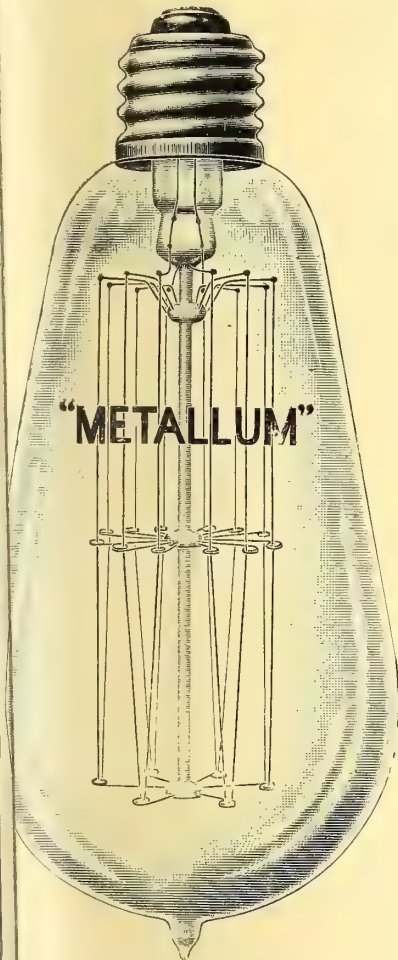


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Metallum Lamps

All Voltages
All Candle Powers
AND
Very Moderate
Prices



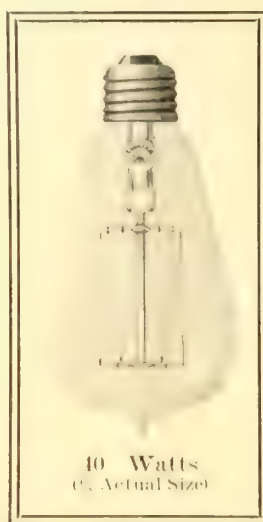
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C. L. Trimingham, Special Representative, 45 Canada Life Bldg.,

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MULTIPLE LAMPS SERIES

DRAWN WIRE (CONTINUOUS) TUNGSTEN FILAMENT

Breakage and fragility have been so far eliminated in the Present **"SUNBEAM"** Drawn Wire Mazda lamps that they are now being used satisfactorily in many locations where Tungsten Lamps were never before used.

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The Sunbeam Incandescent Lamp Co.

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Main Office, TORONTO

Factory, TORONTO

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BOSTON

Exclusive Selling Agents for many Manufacturers. Jobbers of

Everything Electrical

Largest and most complete stock of Pole Line Construction, Lighting, Street Railway and Telephone Material. If you want goods now call on us—we have them. Our facilities are unequalled; our location a distinct advantage for Canadian buyers over other large distributors in the U. S. TRY US.



"Pittsburg" Insulators

meet every requirement in every climate and under every condition and voltage, whether 1,000 or 100,000 volts. They are manufactured in 150 designs, all of uniform body; and glaze to suit your requirements.

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HIGH VOLTAGE INSULATOR CO.**
DERRY, PA.

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Canadian Sales Offices: TORONTO - No. 18 Toronto Street
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RECTANGULAR UNILETS

STEEL — (Not Cast Iron)

Are the most Modern Fittings for Exposed Conduit Work

ONCE TRIED - ALWAYS USED

Because they are much lighter and stronger and at the same time giving more room in the box to do the work than is found in cast iron boxes. They are also very neat in appearance and are now used by the most exacting contractors throughout the land because they **make the job**.

Made in all types and sizes from 1/2" to 1 1/2"



No. 0



No. 6



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No. 5L



Metal Nipple Cover



Blank Metal Cover



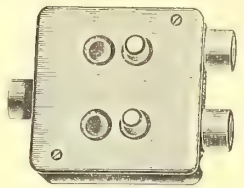
Metal 3 wire Cover



Type No. 2
Switch Unilet

Send at once for
our new circular.

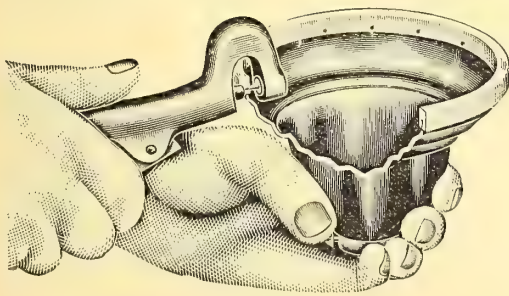
Specify 'Appleton'
on all orders, and
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APPLETON ELECTRIC CO.
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CANOPY INSULATORS



No. 1

PATENTED APRIL 15th, 1911

No. 1. Shows method of fastening Strip Insulator without brads or rivets.

No. 2. Shows Strip Insulator fastened. Included in the list of approved Electrical Fittings issued by the Underwriters National Electric Association.

4" and 10" curles contain from 64" to 66". One 4" curle contains sufficient insulation for four 5", three 6" or two 10" shells.

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Write for Samples and Prices

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TRADE MARK

The New Flame Arc Lamp

Type K

LONG LIFE

BRILLIANCY

EFFICIENCY

SOFTNESS



LOW MAINTENANCE COST

This new lamp embodies the broad engineering experience and unlimited facilities of the largest and leading manufacturer of Arc Lamps. In addition to long life, high efficiency and remarkable light-giving power, this lamp offers unprecedented reliability in service.

A MODEL LIGHTING UNIT

For
Industrial
Purposes

Good lighting increases production by lessening the likelihood of accident, shut-downs, delays, etc.

For
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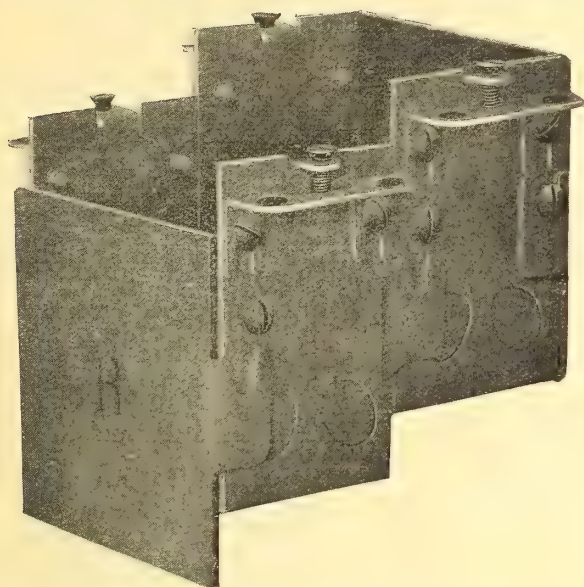
Affords additional safety and convenience to passengers and expedites the handling of baggage.

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Toronto Montreal Halifax Ottawa Cobalt Winnipeg Calgary Vancouver Nelson Prince Rupert

"ROYAL" Switch Boxes and Spaces



Manufactured in Toronto

APPROVED BY NATIONAL BOARD OF FIRE UNDERWRITERS

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Peck Electric Limited

Jarvis and Adelaide Streets :: :: TORONTO
Manufacturers of Electric Automobiles, Switch Boxes, Spaces. Etc.

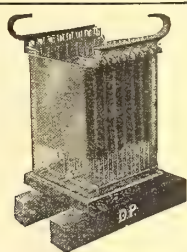
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Protect the INTERESTS of CONTRACTORS &
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IT RESTS WITH THE TRADE
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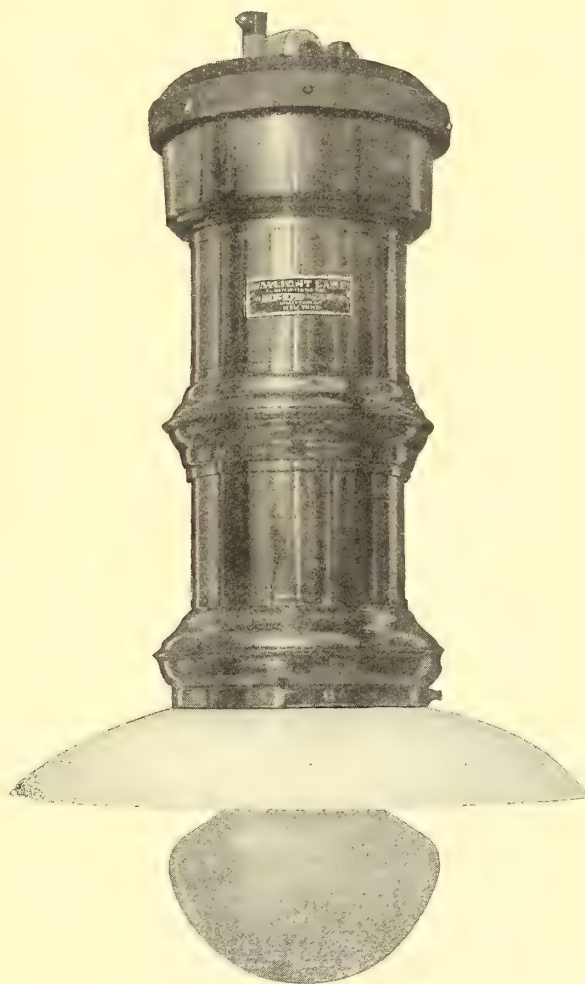
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The Art of Getting Next

A system for side-stepping competition—in obtaining news of sales opportunities in advance of your competitors, is worth while investigating.

An organization that covers Canada—with resident agents in every town of importance—trained men, who are constantly on the alert for sales developing data, is worth while finding out about.

A service that guards against oversight and loss of opportunity—that enables you to select that work which offers the most profit and which you can handle to the best advantage, is worth while having.

Reports that are dependable, accurate, complete, that reach you in time, that eliminate useless missionary work, that give your salesmen real, live opportunities to follow up, are needed in your business.

Of course, you want to know if we can serve you. If so, send a copy of your catalogue—tell us what you sell and where you sell it. Some other live wire may write **to-morrow**—you write **to-day**.

MacLean Daily Reports

220 King St. West, Toronto

Would You Pay \$3 Per Car To Eliminate Damage Suits



so far as accidents in passengers boarding and alighting from cars is concerned?

The I. B. C. Motor-man's Glass gives the motorman a full, clear view of the rear steps at all times. Mirror cannot cloud or "steam" and is very durable. Can be adjusted to any angle and will fit any type or size of car. The illustration shows principle of application.

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C. H. L. Keeler Co. Ltd., Canadian Agents, Toronto
Philadelphia, Pa. New York St. Louis Portland, Ore.



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"KING of CLEANERS"

Vacuum Cleaner

Vacuum, 10 inches mercury basis.
Air displaced, 33 Cubic feet per minute.
Cost of operation, about 1 cent per hour.
Weight, 37 lbs.

A genuine Vacuum Cleaner permanently guaranteed by its maker.

**The Ottawa Vacuum Cleaner
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349 Dalhousie Street, OTTAWA
FRED E. MOORISS General Manager.

A snap for Agents. Let us
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Tenders

A few dollars spent in advertising
your proposals in

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would result in additional competition,
which might save your city or town or
your client many hundreds of dollars.

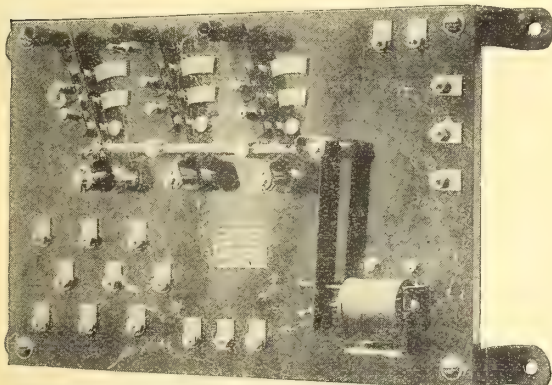
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AND ESPECIALLY SO, SINCE

The "INDEPENDENT"

Controller is without question the most efficient on the market and can be installed and maintained at less cost than inferior types with their trains of breakdowns, vexation and expense. "Independent" Controllers are made in all sizes, shapes and designs for standard usage or special requirements in direct or alternating current service.

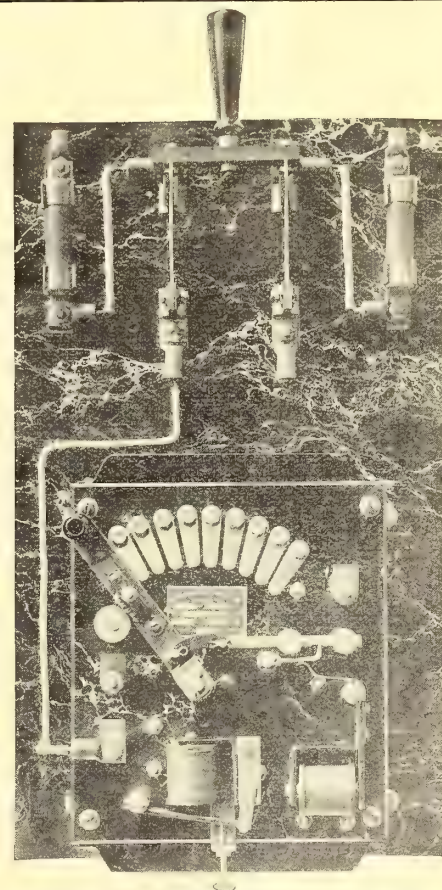
They represent the highest standard of perfection in construction and are thoroughly insulated, fire-proof, moisture-proof, fool-proof, strong and durable and are guaranteed.



3-PHASE, SLIP-RING TYPE SPEED REGULATOR
WITH UNDERLOAD RELEASE.

Our Catalogue Will Solve
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Mailed on Request.

**Independent
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Milwaukee, Wis.,
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UNIVERSAL SPEED REGULATOR WITH
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Carbon and Tungsten Lamps

We are Headquarters for anything in Incandescent Lamps

CARBON

A lamp that will meet class A specifications. Can furnish either 3.1, 3.5 or 4 watts per candle. Try an assorted lot at our case lot price 13 cents.

TUNGSTEN

An imported lamp with a very short tough filament. After Dec. 25th there will be very little difference in price between the 25, 40 and 60 watt sizes. Send for a trial dozen or so. We know you will like them and order more.

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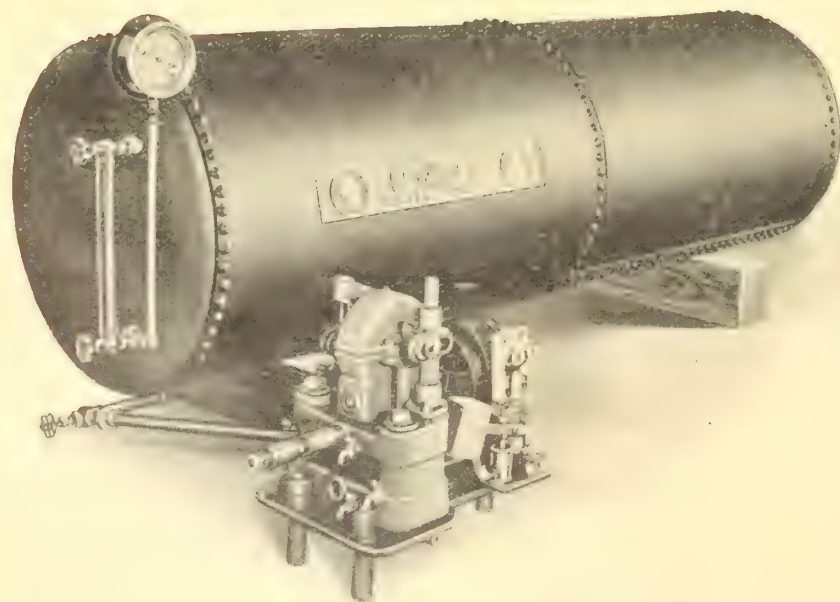
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"Krakno" lighting glassware, New Code fuses, line material etc.

Be sure you write us to-day before you forget, if in a hurry phone at our expense.

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Install Kewanee Systems of Water Supply.

Installation means more current consumed—more profit for you.

It means to the central station operating a day current—an added profit worth while.

It gives your customers a regular city water service and you supply them your current to pump the water.

We have a complete line of electrically driven pumps for all conditions, especially designed from the standpoint of the inexperienced user and the central station man. Pumps requiring motors from 1/6 H. P. to 15 H. P. and pumping from 100 gallons to 12,000 gallons per hour.

Especially designed with the idea of constant load on the motor so current can be taken from regular line—no interference with lightning service.

Kewanee systems are furnished complete—they are easy to install—easy to operate—easy to understand—hard to wear out—but easy to repair.

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ONE LAMP-A-LETTER
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AGENTS WANTED IN OPEN TERRITORY.



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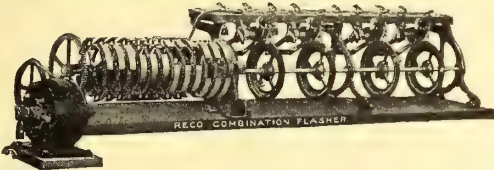
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Flashing Suggestions sent upon request.

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IRVING H. SMITH—406 St. Nicholas Bldg., Montreal



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Billings & Spencer
Limited**

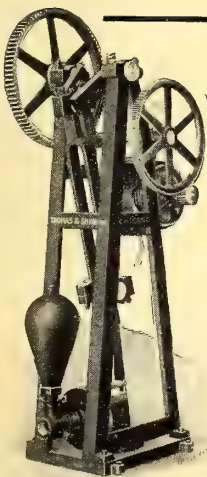
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Yager's Soldering Fluxes

Yeager's Soldering Salts have been the standard for 35 years and there are none better for **Quality and Service**. We now offer "YAGER'S" FLUXES made from the base of Yeager's Salts, in four forms to suit your convenience. Salts, Stick, Paste and fluid. All non-acid fluxes that make perfect electrical joints stronger than original.



Deep Well Working Head.

"ACME"

AIR WASHERS, PURIFIERS,
COOLING AND HUMIDIFY-
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Located at Toronto

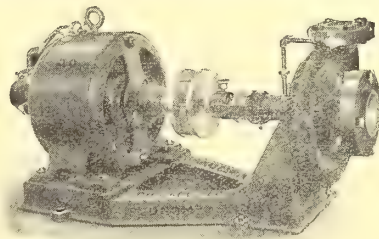
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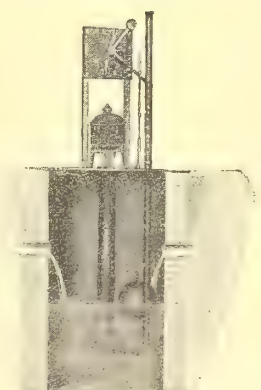
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THOMAS & SMITH, Inc.

116-118 N. Carpenter St. 416 Broadway
CHICAGO, ILL. NEW YORK CITY



Direct Connected Centrifugal Pump.



Automatic Electric Bilge Pump.

COMPACT IN CONSTRUCTION A GIANT IN STRENGTH



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Your telephone line will not give efficient service to subscribers unless your generators produce electrical pressure great enough to overcome the ordinary resistance of the line and in the case of bridging generators, the current forced through by this pressure must be of sufficient quantity to ring all the bridged bells connected across the line.

This Kellogg generator is a giant in strength and its mechanism is absolutely accurate.

It will ring your bells — EASILY — CLEARLY — POSITIVELY.

Send for our Bulletin No. 54

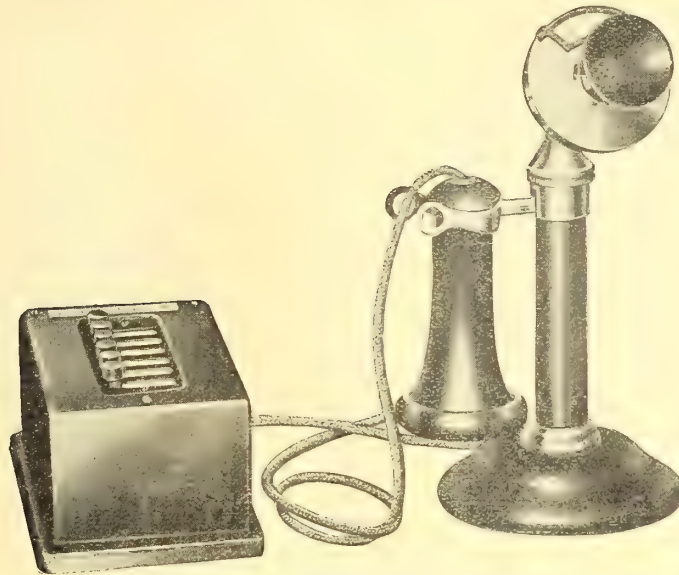
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KANSAS CITY, MO.

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SAN FRANCISCO, CAL.

You Must Not Buy a Cheap System



CODE NO. 905 TYPE—6-STATION

INTER-COMM-PHONE

Every business man will consider a means of increasing the efficiency of his organization. You can convince him that the Inter-Comm-Phone System eliminates confusion, noise and demoralization of employees and executives continually running about to receive or carry out instructions. It binds various departments and their heads together into a systematic time and labor saving organization.

There are many business organizations in your city that you could interest with the Inter-Com-Phone System. It's to your interest and theirs to get after this business. The No. 905 6-Station Desk Telephone is ideal for a small installation. The compact key box includes the automatic key and

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You must not buy a cheap system—expensive to maintain—difficult to install and not up to high standard of the Inter-Comm-Phone's quality.

We make the most complete variety of types in 6- 12- 22- and 32-station capacity. More information will be found in Booklet No. 2669—send for it.

May we ship you a sample instrument?

PREFERRED BY DISCRIMINATING DEALERS EVERYWHERE

Stromberg-Carlson Telephone Mfg. Co.

No. 72 Victoria Street
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Our Latest Addition to Our Line



Electric Luminous Radiators

The first of their kind to be built complete in Canada.

The workmanship and Material on our Radiators cannot be excelled.

Write today for discounts and literature.

National Electric Heating Company, Limited

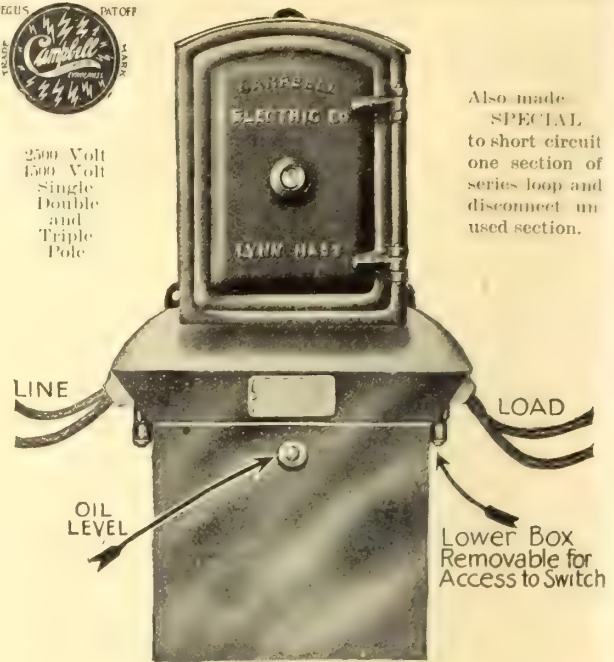
544-548 Queen Street East

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Central Stations—AUTOMATIC CONTROL OF OUTLYING DISTRICTS



2500 Volt
1500 Volt
Single
Double
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Triple
Pole



Also made
SPECIAL
to short circuit
one section of
series loop and
disconnect an
used section.

TYPE "E"
Eight Day Time Switch
High Tension Oil Break
WEATHERPROOF

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CAMPBELL TIME SWITCHES—BELL RINGERS,
X-RAY AND HIGH-FREQUENCY APPARATUS
THERMO FLASHERS. OZONE GENERATORS

Cook Wedge Split Insulator

Protected by U. S. Patents



Made from hard white porcelain and very carefully manufactured.

No burrs or rough edges to cut insulation.

Write for prices and sample.

The success of this insulator is due to the fact that the cap needs no centering and firmly grips the wire when screwed into place.

Trial orders packed 500 in a box.

Made only by

COOK POTTERY CO., Trenton, N.J.

Carried in Stock by large Jobbing Houses
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Rush Jobs

The quality of insulation used on hurried repairs is more important than in ordinary work, because the danger lies right there—in the hurry. If time is precious, material should be the best.

For those quick splices the best is
"A" SPLICING COMPOUND.

Walpole Rubber Co. Limited
MONTREAL CAN.

Liquid and Rubber Insulation

American Co.—MASSACHUSETT CHEMICAL CO.
Walpole, Mass.

Pioneers in Insulation Engineering

BURGLARS !

Imagine the folly of entrusting the efficiency of a burglar alarm system to two sickly, uncertain batteries in the basement! While they would be making up their minds a

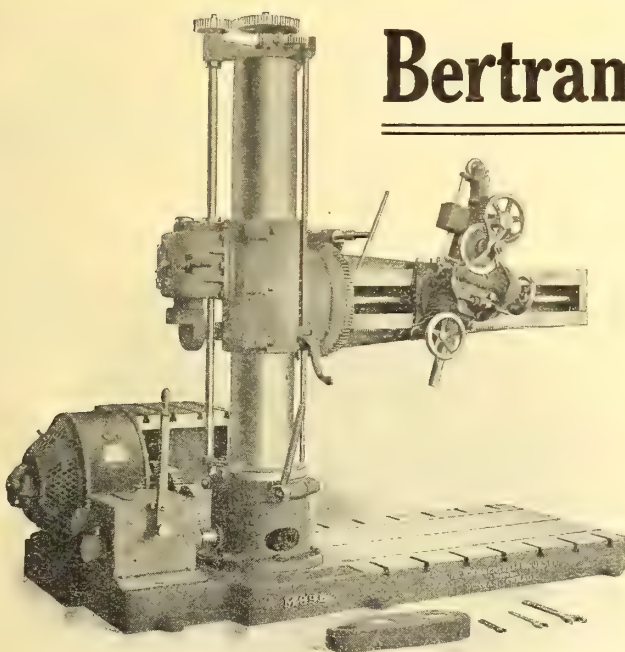


THORDARSON Junior Bell-Ringing TRANSFORMER

would have roused the whole neighborhood. It uses good live current; injects a healthy vigorous ring into bells, buzzers and burglar alarms that means business. **30%** more efficient than any similar transformer. Current will not register upon ordinary watt meter. Easy to put up—easy to sell. Why not stock up with it?

Write for particulars, prices and discounts today

Thordarson Electric Mfg. Co.
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Bertram Drilling Machines

We manufacture Drilling Machines for all classes of work, including

Vertical Drilling Machines
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Radial Drilling Machines
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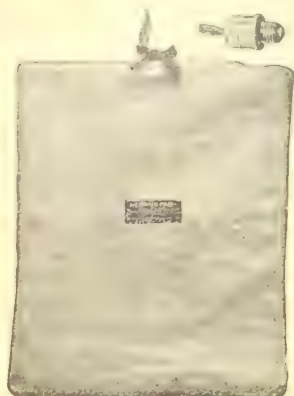
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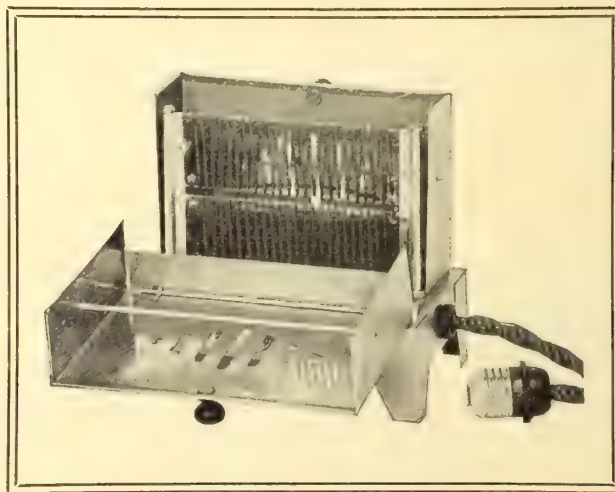
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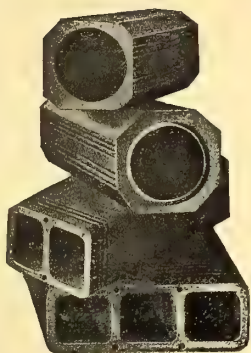


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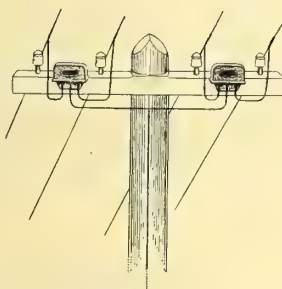
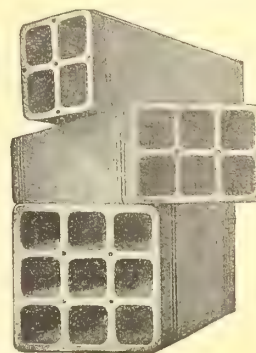
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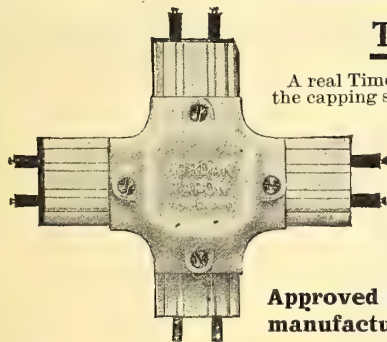
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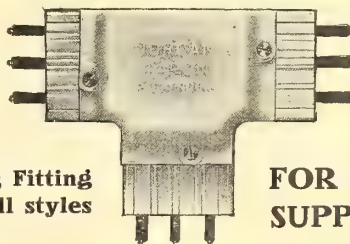
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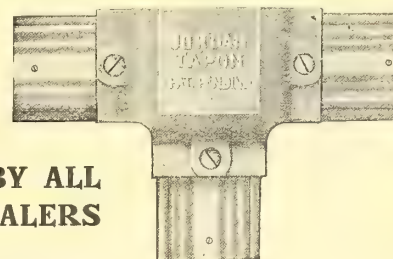
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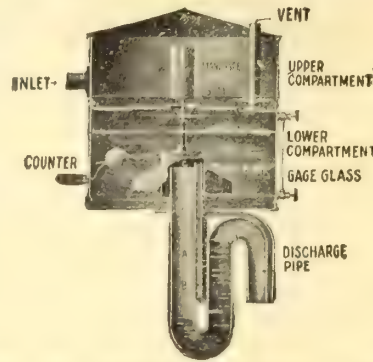
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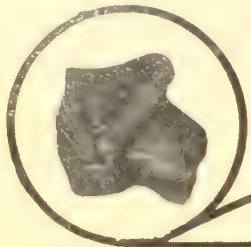


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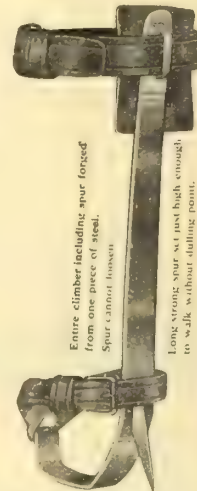


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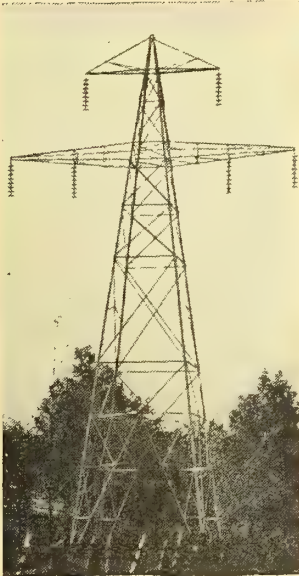
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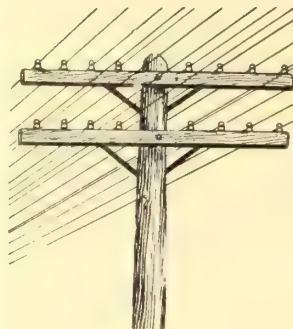
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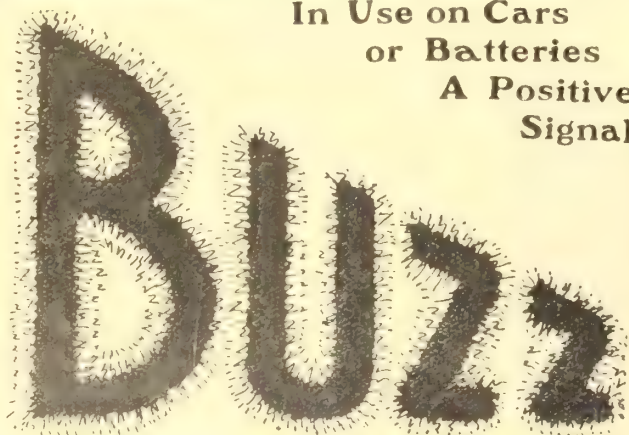
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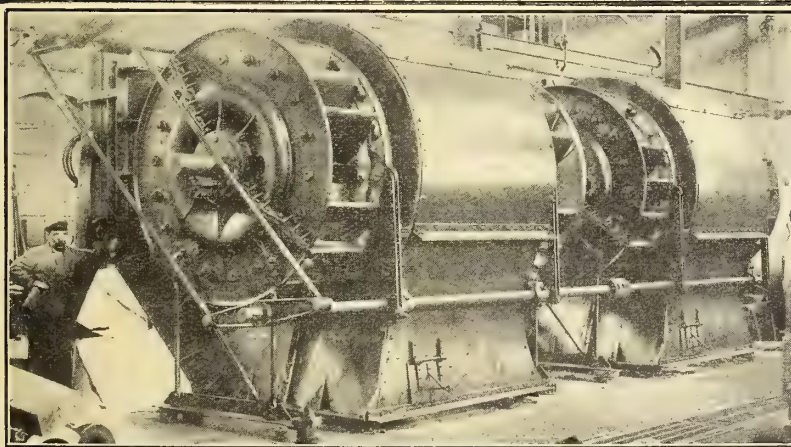
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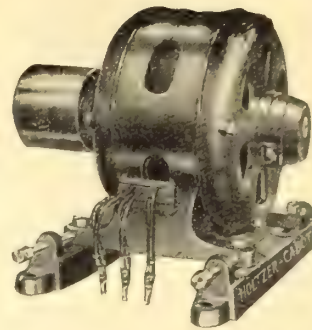
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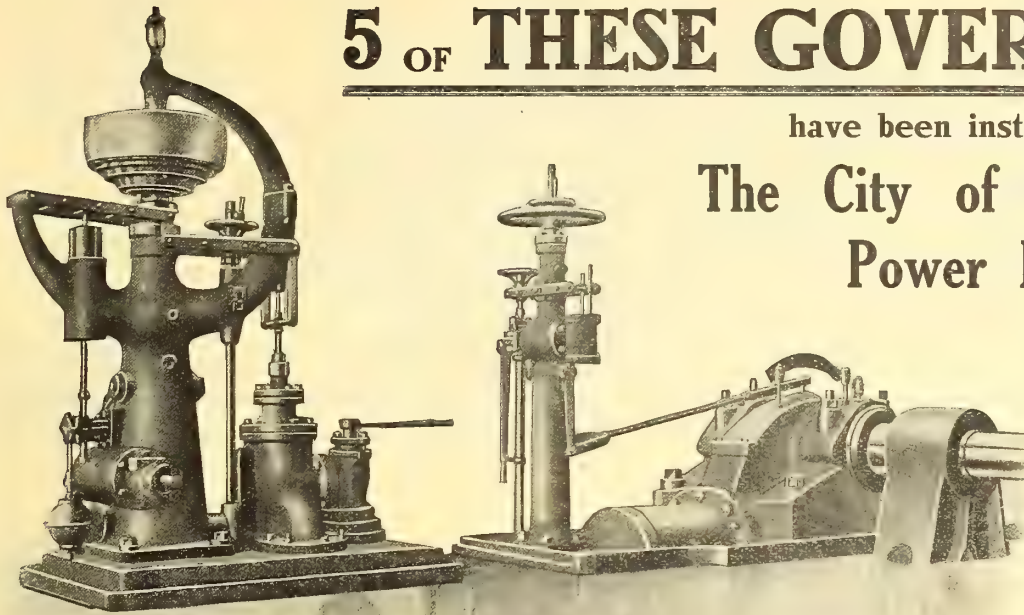
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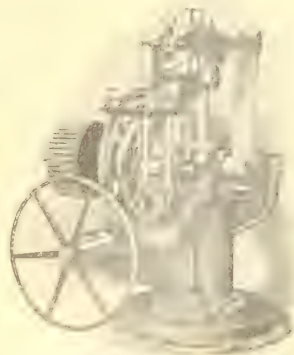
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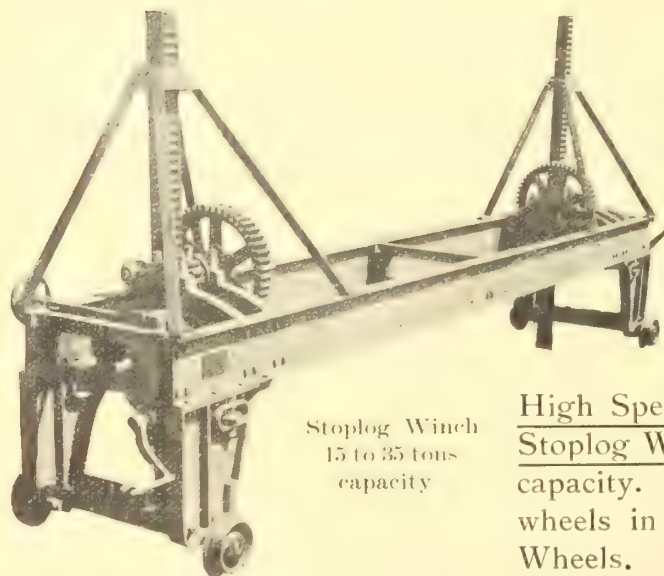
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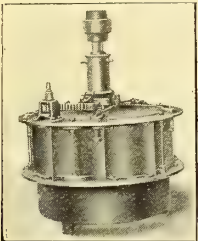
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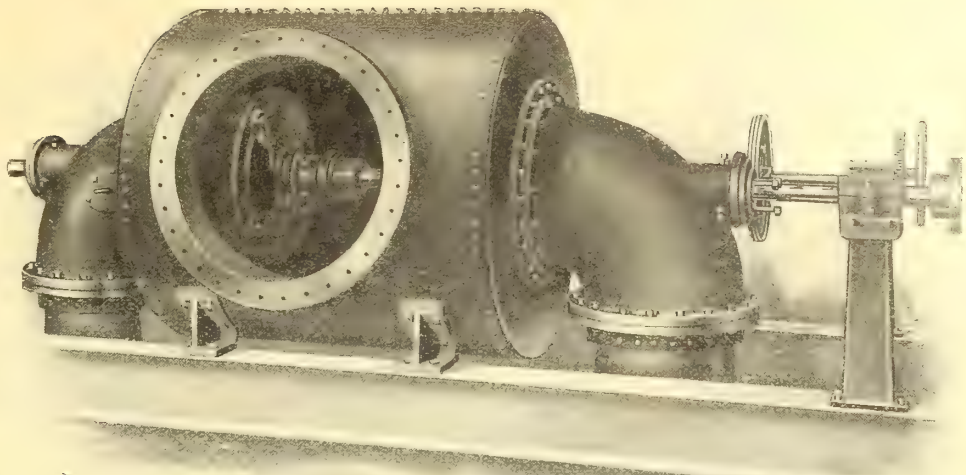
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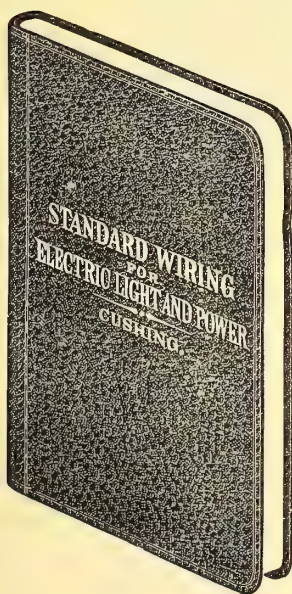
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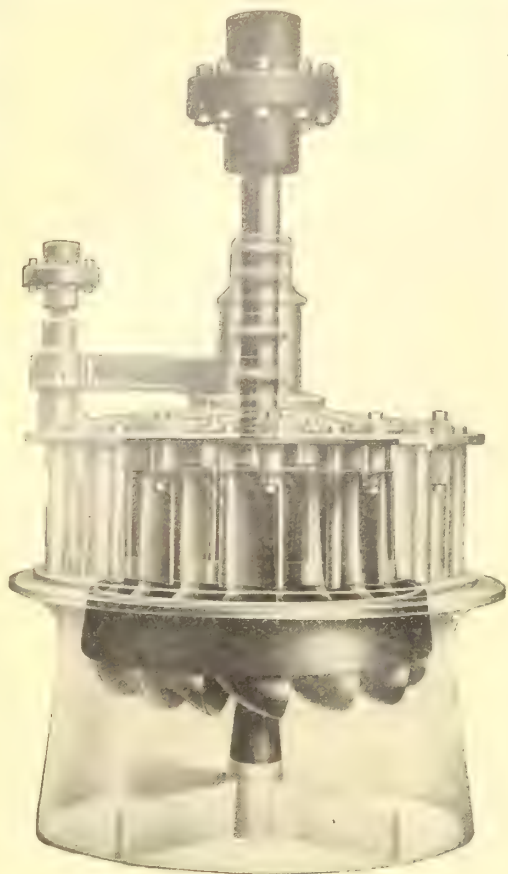
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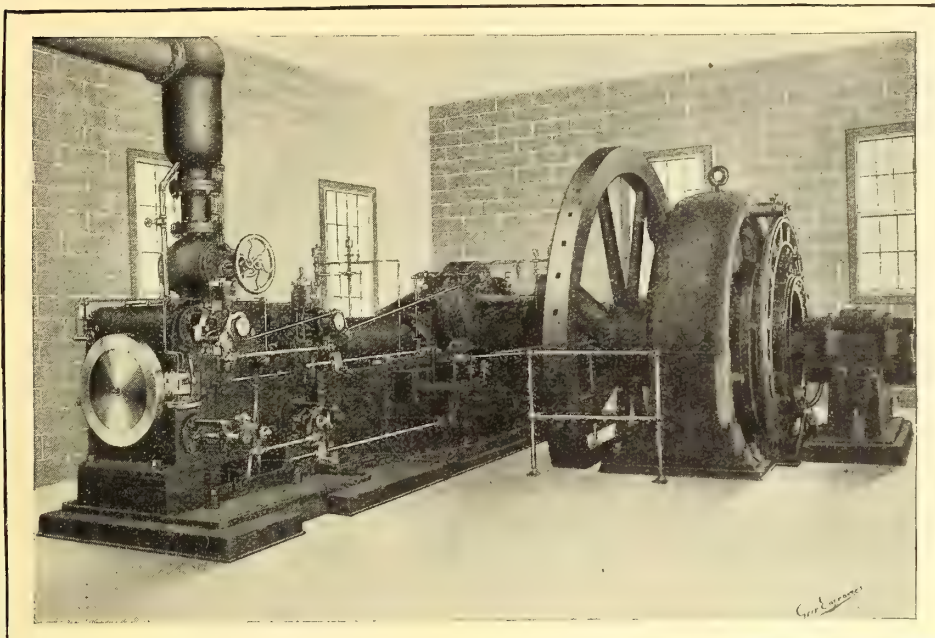


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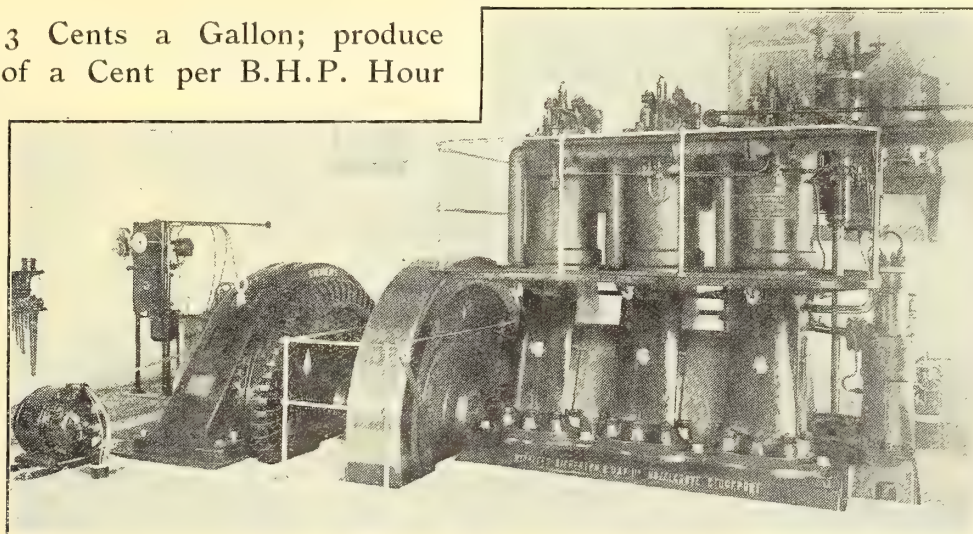
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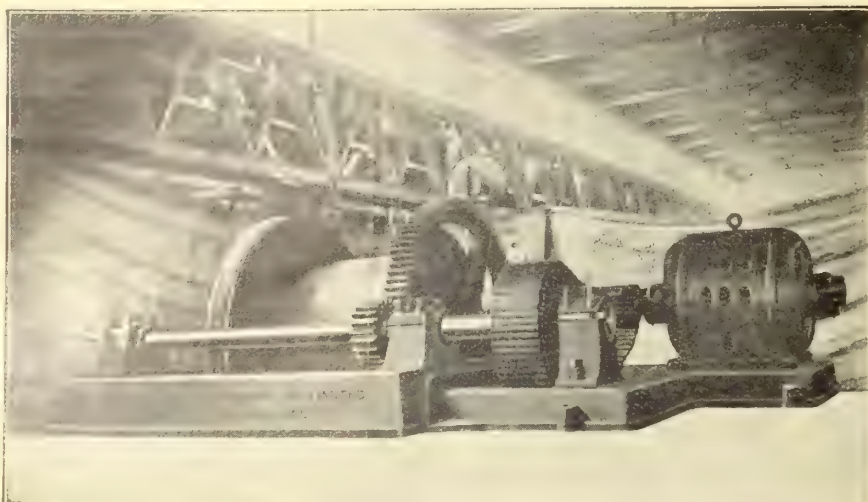
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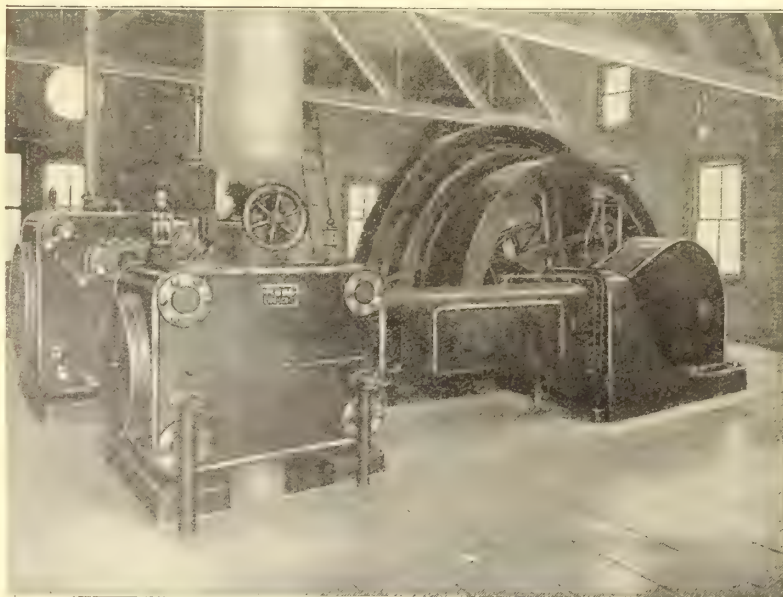
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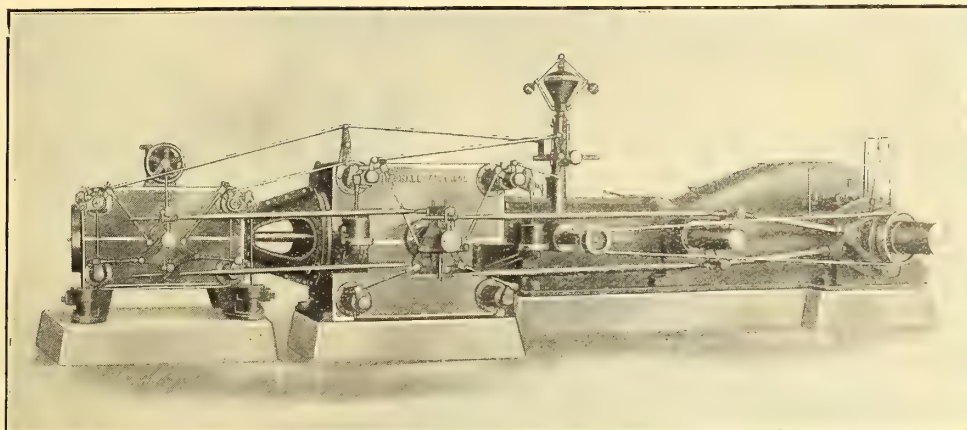
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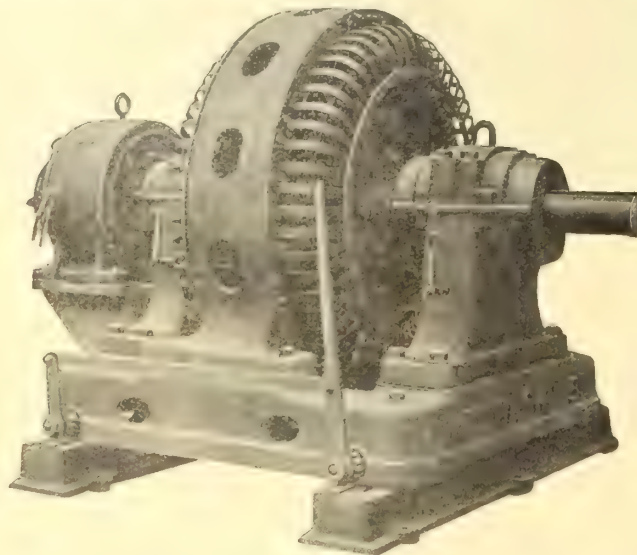
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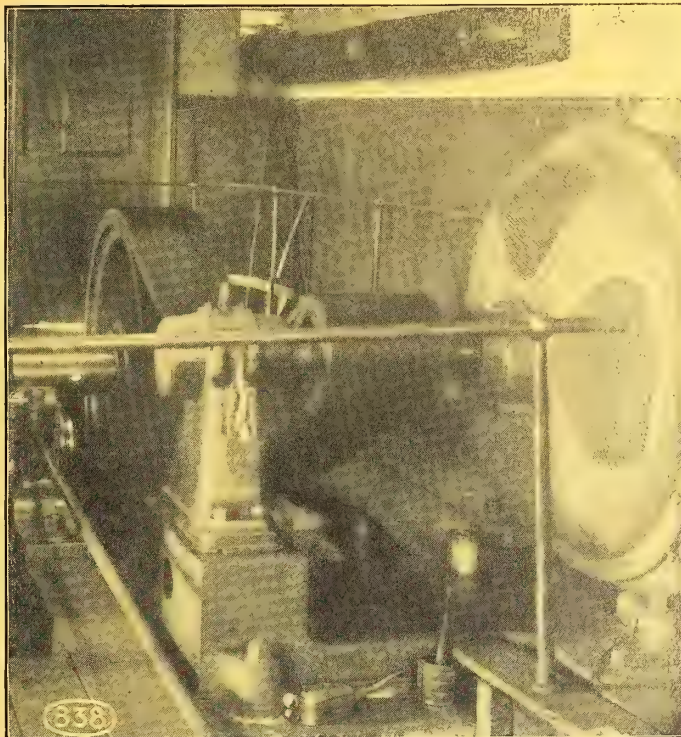
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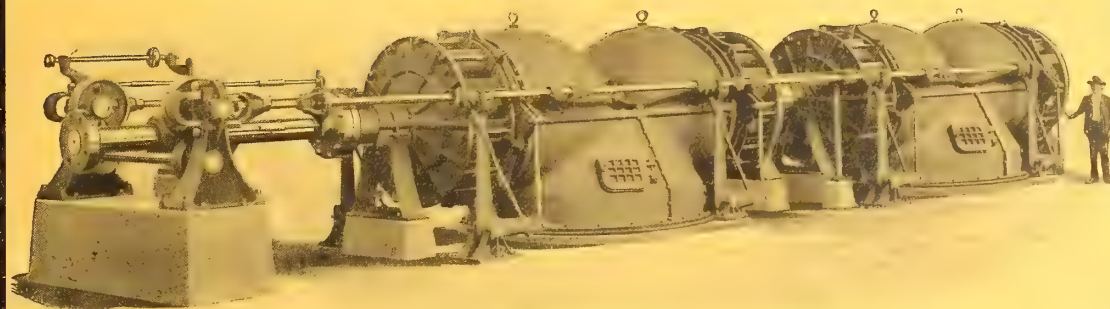
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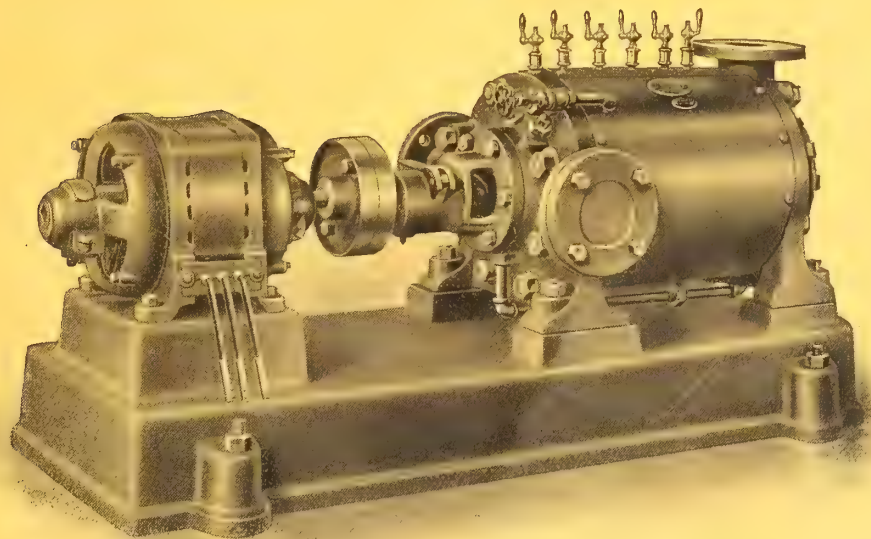
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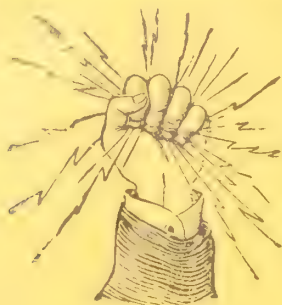
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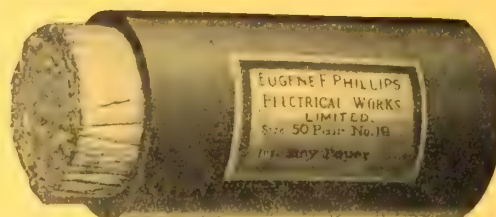
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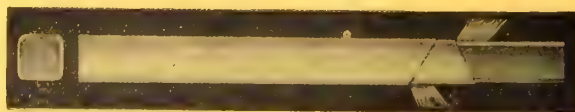


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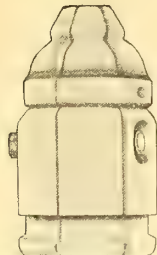
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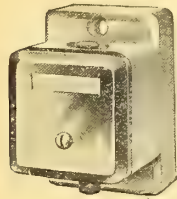
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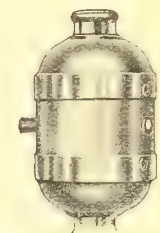
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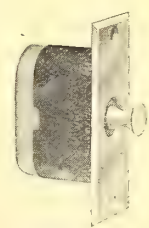
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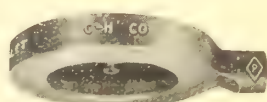
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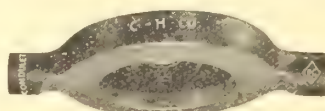
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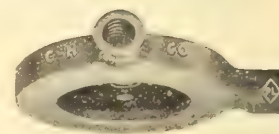
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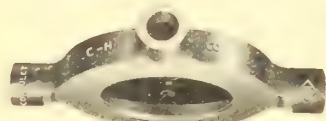
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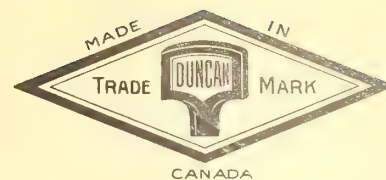
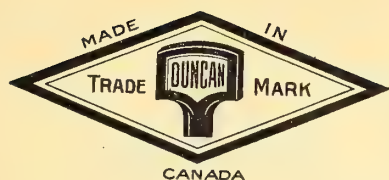
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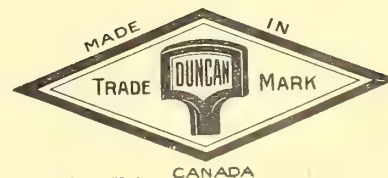
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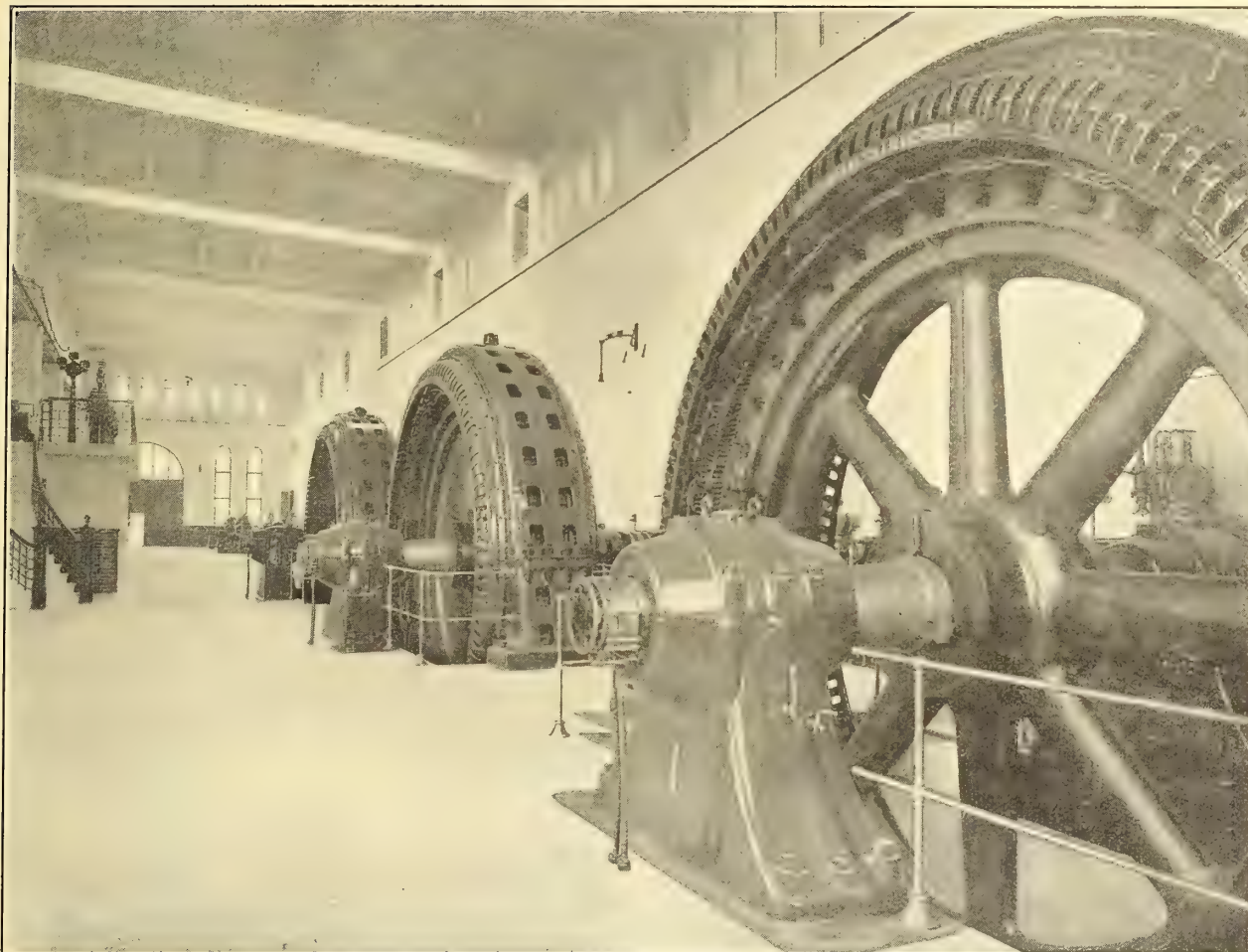
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Electric Railway Improvement Co.	34				
Electric Service Supplies Company	36				
Electric Repair & Contracting Co.	100				

The Advertisements in the "Electrical News" represent the leaders in their line



X Cell Dry Batteries

**QUALITY
SERVICE
POLICY
PRICES**

29.3 per cent. BETTER than others.
Immediate Shipment.
Protection of Jobbers and Dealers.
Right—ask us about our 1912 proposition.

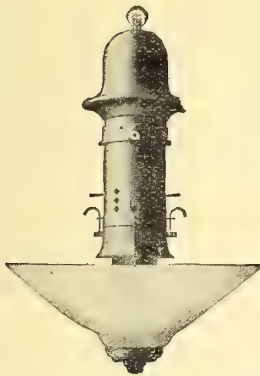
Canadian Carbon Co.

Limited

X CELL BATTERIES

CARBON PRODUCTS

96 King St. W., TORONTO



Semi-indirect Lamp
Cover 195



Inverted Lamp
Cover 45

Three Standard Types of Inverted and Semi-inverted Arc Lamps for lighting interiors to get "daylight" illumination.



Semi-indirect Lamp Cover 68

CANADIAN UNION ELECTRIC CO LIMITED

CHIEF OFFICE:
MONTREAL

ELECTRIC FLOUR MILL

DESIGNED BY
J. H. HAMMILL

DESIGNED BY
J. H. HAMMILL

MANAGING DIRECTOR



HEAD OFFICE: BOARD OF TRADE BUILDING, TORONTO.

CAPACITY 12000 BBLs DAILY

ALL ACCEPTANCES SUBJECT TO OUR CONFIRMATION

Allis-Chalmers Co.,

Milwaukee, Wis

Port Colborne, Nov. 9-11.

Gentlemen:

We hereby hand your representative, Mr. J. H. Hammill acceptance of our 4000 barrel flour mill which you have just completed. As you are aware this contract included in addition to the flour mill, the complete electrical equipment consisting of motors, transformers, switchboards, etc. which are manufactured at your Montreal Plant. In handing you this acceptance we are pleased to say all machinery and electrical equipment supplied under this contract is working satisfactorily.

The mill started without any trouble whatever, in fact we think our record of starting exceptional from the fact that in less than three hours after placing the wheat on the mill the flour was up to grade and ready for market. The mill is now running full time and capacity, and we have not found it necessary to make any changes whatever, every spout and cloth being correct.

This is the second large complete flour mill you have built for us, having built our Kenora mill in 1909, and we are pleased to say that you have not only sustained your high standard of mill building as shown in our Kenora mill, but we consider you have surpassed your former efforts, in this case, and that our new Port Colborne mill stands unexcelled in point of equipment and efficiency in America.

Yours very truly,

JSB/B

Maple Leaf Milling Co. Limited.

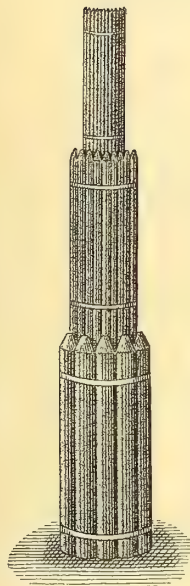
Per *J. H. Hammill*
Mechanical Supt.

Canadian Carbon Co. Limited

96 King Street W., TORONTO

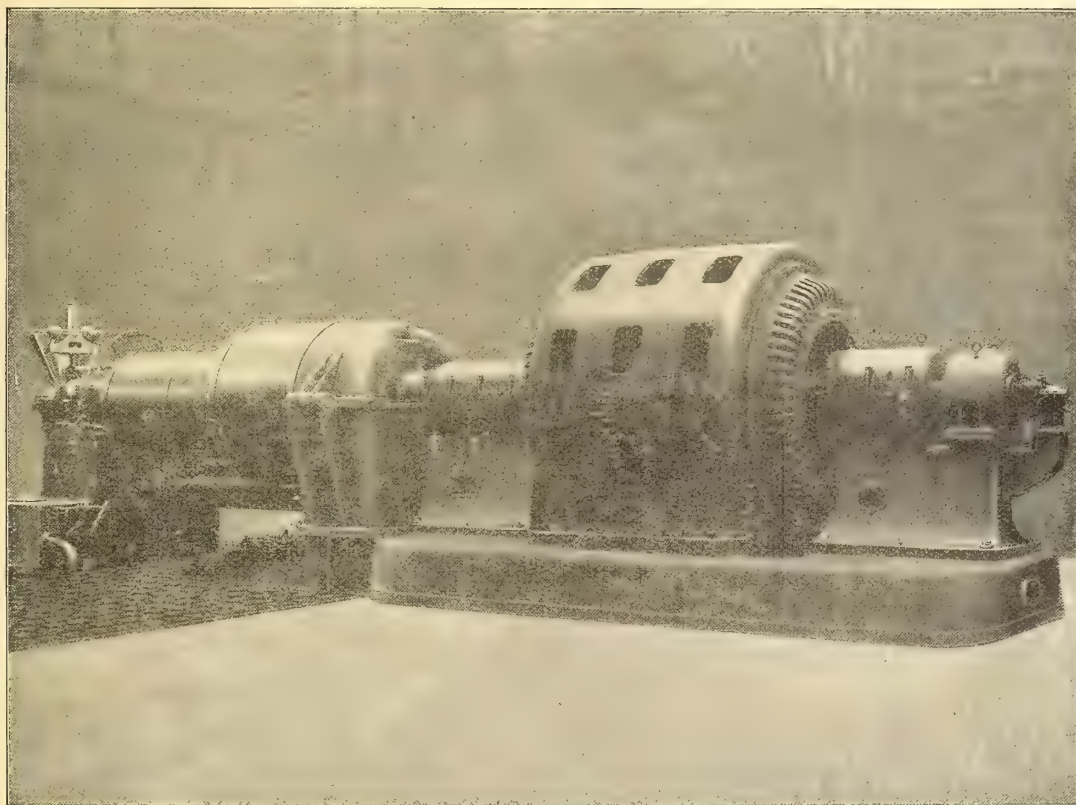
carry in stock the famous "PLANIA"
Highset Grade Carbons for

FLAME ARC, D.C. or A.C., all colors
ENCLOSED ARC
OPEN ARC
PICTURE MACHINES



Our Carbons are made from special selected coal, which contains less impurities than any other coal in the world, therefore Ash Deposit is practically nil. They give a steady bright light and are perfectly straight. Each carbon is hand guaged, also free from blisters.

SOMETHING ELSE — There is money in our Carbons — ASK US HOW



This illustration shows a Peebles 2,000 K.W. 6,600 volt 50 cycle alternator arranged to run at 1500 r.p.m. and as supplied to various Corporations and Supply Companies.

These machines are of a revolving field Stationary Armature type, the end windings being supported in a very substantial manner.

VANDELEUR & NICHOLS

Toronto and Montreal

Public Service Corporations

desiring to finance their needs by the sale of Bonds are requested to communicate with us.

We deal extensively in the bonds of Hydro-Electric Power Companies, Electric Railways, Gas Companies and Electric Lighting Companies which meet our requirements.

E. H. Rollins & Sons

Investment Bonds

200 Devonshire St.

Boston, Mass., U. S. A.

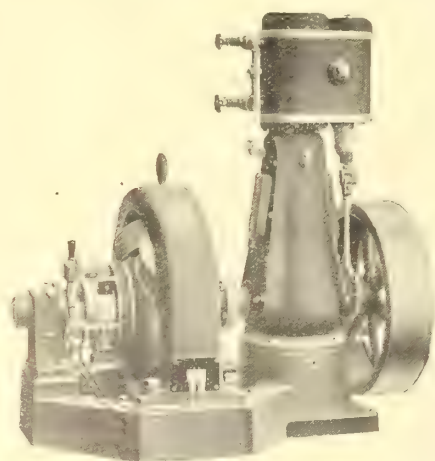
**We Purchase Outright
entire issues of bonds
on steam and elec-
tric railroad, gas,
electric and
hydro-electric
properties**

N.W. HARRIS & CO.

Established 1882
Incorporated 1911

35 Federal Street, Boston, U.S.A

EFFICIENCY



By Efficiency in a Generator we mean one that will give you maximum output for the least expenditure of driving energy.

**Toronto & Hamilton
Electric Company**
Hamilton, Ontario

Central Electric & School Supply Co., Limited

36 Adelaide St. West, - TORONTO, ONTARIO

**Electrical Supplies of Every
Description**

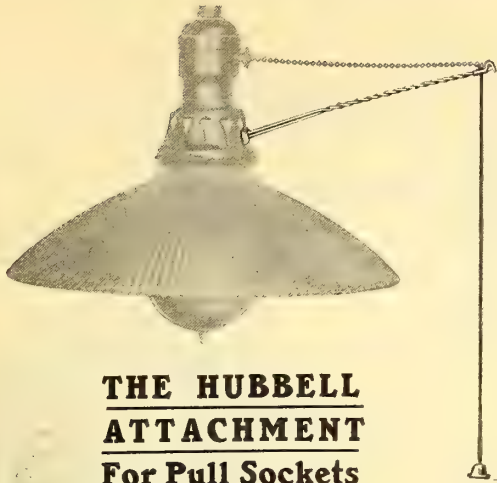
A few of our specialties:

**Moloney Transformers
Rigid and Flexible Conduit
Condulets**

LARGE STOCK

PROMPT SHIPMENTS

Write for Catalogue No. 3



THE HUBBELL ATTACHMENT For Pull Sockets

This device makes the easiest working Pull Socket work easier. It reduces strain on the socket chain, takes all drag off the chain guide, increases the utility of the socket and lengthens the life of the lamp.

The arm is sufficiently long to allow the cord to hang beyond the edge of the shade.

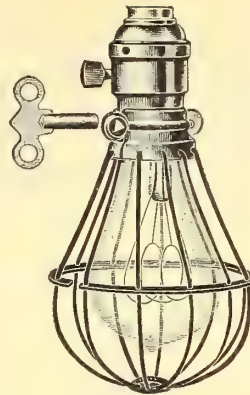
A slight pull on the cord operates the socket without tilting the lamp or causing harmful vibration.

The Hubbell Attachment is protected by the following patents:

No. 904,476, Nov. 11th, 1908
No. 979,693, Dec. 27th, 1910
No. 989,845, Apr. 18th, 1911
No. 956,354, Apr. 26th, 1910

Dealers and Contractors wishing quotations and samples should address

R. E. T. PRINGLE, Manufacturers' Agent
Montreal Windsor Toronto



LOXON

LAMP GUARD

THE KEY TO SAFETY

Burned out Lamps are the only ones to be replaced when Loxon is used.

**No more Lamp Theft—No more
Breakage—Fire Danger Lessened**

All this made possible by LOXON.

Loxon locks on with a key and protects against all kinds of loss—not possible with guards fastened only with set screw or wire

A Loxon costs no more than a lamp and saves many.

To users who will write on their letterhead, we will send **FREE SAMPLE FOR TEST.**

Carried by all Canadian Electrical Dealers.

McGILL MFG. CO.
5 OAK ST., VALPARAISO, IND.



Largest Exclusive Electrical Supply House in Western Canada

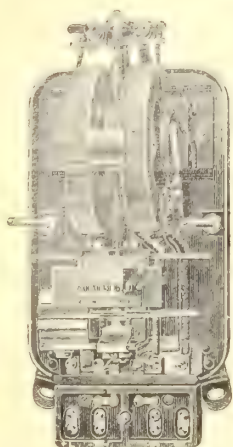


We Cover NORTHERN ONTARIO, MANITOBA, SASKATCHEWAN and ALBERTA.
Advise us by post card and we will have our traveller personally call on you.
All lines of standard electrical material carried in Winnipeg stock. **PROMPT SHIPMENTS,
STANDARD PRICES, COURTEOUS TREATMENT.** If you are NOT a customer, you
SHOULD be. It will pay you as well as ourselves.

Write for our new 1912 calendar.

The James Stuart Electric Co.
324 Smith St., Winnipeg, Man. Limited

WATTMETERS



D. C. Bergmann Wattmeter

During the past month, we have closed contracts for over 1,500 wattmeters, the larger portion for use on Hydro Electric Commission Lines.

Our prices, like our meters, are right.

We will gladly send sample meter to any recognized company for approval.



A. C. Bergmann Wattmeter

Chapman & Walker, Limited

Head Office : 69 Victoria Street, TORONTO, ONT.

Vancouver

Calgary

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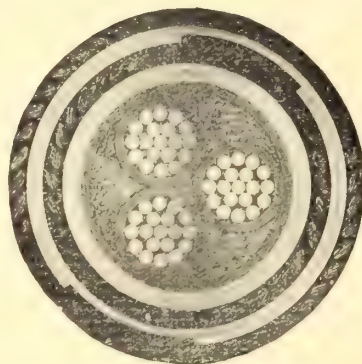
Winnipeg

V. I. R. Cables

Wire, Flexible

Paper Insulated
Lead Covered
Cables

Telephone Cables



.075 sq. in. three core, circular
lead covered, steel tape
armoured cable

MONTREAL AGENTS:

Alexander Macpherson & Son,
Montreal, Que.

Vulcanized Bitumen Cables

Transmission
Lines

Trailing Cables

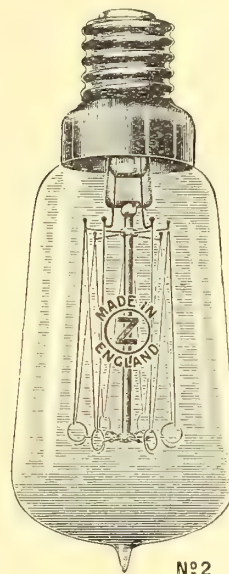
TORONTO AGENTS:

Chapman & Walker, Limited
69 Victoria Street
Toronto, Ont.

W. T. Henley's Telegraph Works Co. Limited

Contracts taken for complete Cable Systems installed

"Z" LAMPS



One of the greatest troubles with Tungsten Filament Lamps, a black deposit on the glass, has been successfully overcome in "**Z**" **Tungstens** by coating the stem of the lamps with **Phospham** which chemically absorbs the black deposit given off by the filament, thus keeping the bulb **as clear as a new lamp**. All "**Z**" lamps are fitted with **Standard Vitrite Insulate Bases**.

We have always in stock or on transit over 100,000 Carbon and Tungsten Lamps, which insures prompt delivery the same day as order is received.

Chapman & Walker

ENGINEERS AND CONTRACTORS

Head Office: 69 Victoria Street, Toronto, Ont.

MONTREAL, QUE.
Branch Office
406-407 St. Nicholas Bldg.

WINNIPEG
150 Princess St.

VANCOUVER
Branch Office
Imperial Block

CALGARY
General Supplies, Ltd.
1233 Second St., E.

PORCUPINE
J. P. Bartleman

Stock Carried in Montreal, Toronto, Winnipeg, Calgary and Vancouver



Crocker - Wheeler

Standard Induction Motors

Are Built to Work

THEY HAVE

Large Shafts

Lumen Bearing Journals

Dustproof Bearings

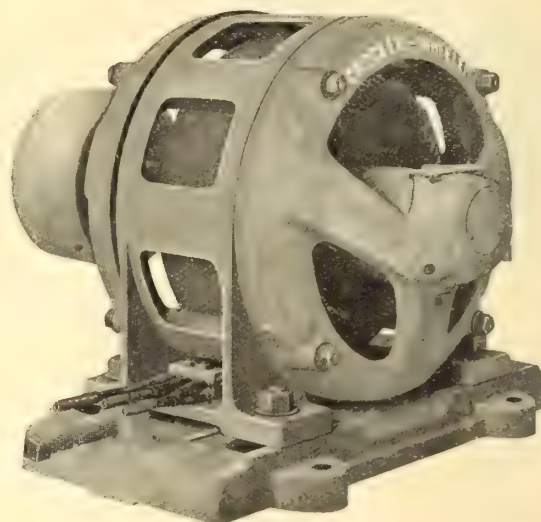
Ideal End Ring construction

Rugged Stator Frames

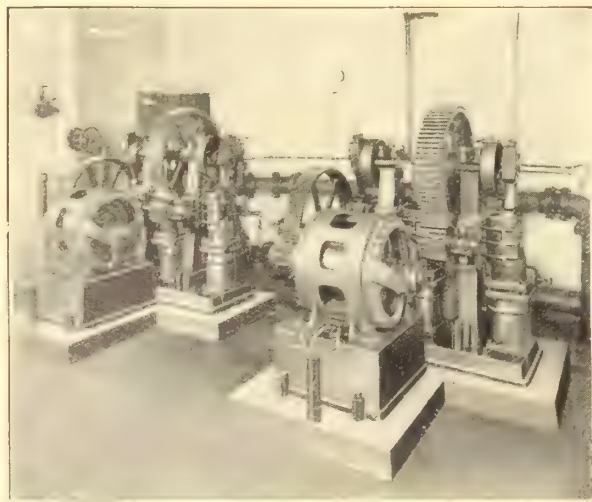
Open Stator Slots with

Metallic Coil retaining wedges.

and **ADJUSTABLE AIR GAP**



**THEY RETURN TO YOU THE GREATEST
PROFIT ON YOUR INVESTMENT**



BECAUSE THEY

Are readily adapted to meet special requirements of drive and service.

Have high power factor

Have high efficiency

Have large overload capacity

ARE BUILT IN CANADA

Canadian Crocker - Wheeler Co.

Manufacturers and Electrical Engineers LIMITED

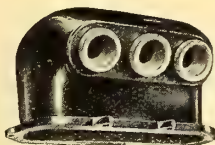
HEAD OFFICE AND WORKS: **ST. CATHARINES, ONT.**

BRANCH OFFICES : **MONTREAL, QUE.
VANCOUVER, B.C.**

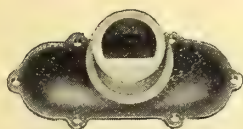
Two in One—A Switch and a Cut-Out

Conduit Fittings

Illustration shows a three-pole "Noark" Service Box for use with or without conduit wiring. For conduit work the fittings with gaskets make this box water-tight.



Entrance Hood



Straight-away

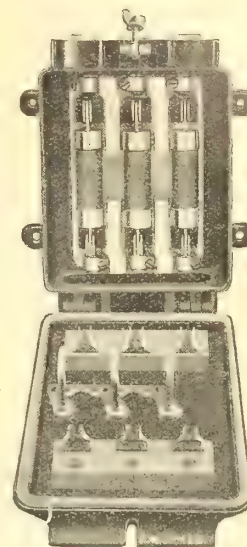


"NOARK" Service Box

has a handle on the center of cover which operates three fuse carrier hooks in the box. When it is desired to place the fuses in circuit, this handle is turned so that it points downward. The fuses are then slipped into the aligning clips in the cover and the handle turned so that it points to the right. The cover may then be closed or opened inserting or withdrawing the fuses. If, when the box is closed, it is desired to examine the condition of the fuses without breaking the circuit, it is necessary only to give the operating handle one-quarter of a turn. This releases the fuses and permits the cover to be opened, leaving the fuses in the contact clips.

"Noark" Service Boxes are approved by the Underwriters' Laboratories for use as a switch and a cut-out.

The "Noark" line of Boxes covers a wide range and variety of uses, applicable to all forms of installations.



Write our nearest branch for Catalog 405

THE CANADIAN H. W. JOHNS-MANVILLE CO., LIMITED

Manufacturers of Asbestos and Magnesite Products
Toronto, Ont.

Montreal, Que.

ASBESTOS

Asbestos Roofings, Packings, Electrical Supplies, etc.
Winnipeg, Man. Vancouver, B. C.

Have You Solved Your Lighting Problems?



Holophane D'Olier Steel Reflectors



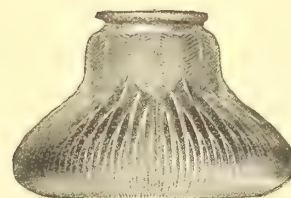
Benjamin Flat Cone Reflector

We illustrate a few of the many complete lines of reflectors which we carry in stock at all our branch houses.

These reflectors are designed with strict regard to scientific principles of illumination. They are especially suitable for use in factories, offices, stores and public buildings in combination with the various types of high efficiency lamps.

Write to-day for our Bulletin No. 2031.

Remember that Good Lighting costs less than Poor Lighting



Holophane Glass Reflectors for Residence use



Benjamin Bowl Reflector

THE Northern Electric AND MANUFACTURING CO. LIMITED

Manufacturer and Distributer of Telephone Apparatus, Electrical Supplies, and Fire Alarm Apparatus for every possible need.

MONTREAL TORONTO WINNIPEG REGINA CALGARY VANCOUVER



Packard

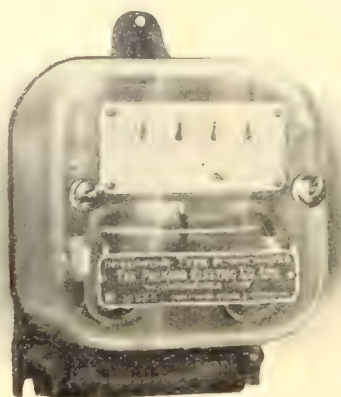
METERS

Absolutely Reliable

Type

“K”

Perfect Workmanship



TYPE K GLASS CASE



TYPE K METAL CASE

**Accurate
on
Light
Loads**

—
**Output
Increased**



TYPE PK POLYPHASE

**Guaranteed to Meet
the Most Exacting
Specifications**

—
Prompt Shipments

Write for New Full Descriptive Bulletin No. 120

The Packard Electric Company, Limited

Factory: ST. CATHARINES

General Sales Office
26 Adelaide Street West, TORONTO

Phone M. 1002

N. W. Office and Warehouse
WINNIPEG

A Western Made Battery

FOR USE IN THE WEST

Manufactured in Winnipeg



X CELL BATTERIES have gained many friends during the past year principally because WESTERN Battery Users find that X CELLS can be depended upon ALWAYS.

WESTERN Dealers who handle Winnipeg-made X Cells satisfy and retain their customers because it is always possible to have ABSOLUTELY FRESH CELLS on hand.

The demand for a RELIABLE and EFFICIENT Battery is steadily increasing in the WEST. Be ready for this demand. Get in touch with your Jobber or write the WINNIPEG factory.

Ask for the "X CELL," the Battery with "NINE LIVES"

Canadian Carbon Company, Limited
Bury and Irish Ave., WINNIPEG

Chandelier Chains

BRASS and STEEL

LARGEST VARIETY OF
DESIGNS IN CANADA

*Write for Art Calendar and
Catalogue.*

W. H. Banfield & Sons

MANUFACTURERS

120 Adelaide St. W.

TORONTO, ONT.

O-B Lock Hanger



O-B Type N Lock Hanger

Every user of "Round Top" Hangers will be interested in our new O-B Lock Hanger which fills a long felt want.

This device makes it possible to screw the ear up **tight** against the hanger and at the same time permits the ear to be **aligned perfectly** with the trolley wire; the advantage is obvious.

In preliminary service tests on a large road, the superintendent reported that the O-B Lock Hanger made such a "hit" with his lineman that he had to lock them up in order to get the men to use up the old style hangers on hand.

The O-B Lock Hanger is made in three types, viz :—Types N, F and L similar to our standard types of Round Top Hangers as listed on pages 28 and 29 of Catalogue No. 8.

Let us give you full particulars now, so you will be in a position to specify O-B Lock Hangers on your next order.

*Our personal representative will call with
a sample and explain on request.*

The Ohio Brass Co.
Mansfield, Ohio, U.S.A.

Men Who Know Conduits

Invariably Specify

"Galvaduct" and "Loricated"



STEAMER "HAMONIC"—A GALVADUCT BOAT

THE CONDUIT QUESTION ?

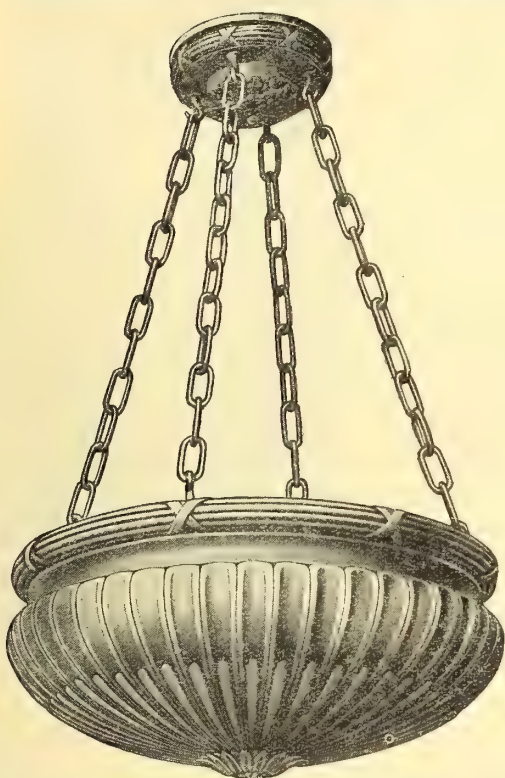
Every exacting engineer and architect is vitally interested in Conduits because the question of conduit protection is an absolute necessity in modern building and engineering practice.

We are prepared to submit convincing proofs that "GALVADUCT" and "LORICATED" Conduits give longer life, better service, and more clearly meet the conditions for which they are made than any other conduits produced.

Conduits Company Limited

Toronto and Montreal

YOU CAN'T BEAT DAYLIGHT



The Eye-Comfort System of Indirect Illumination

comes nearest to daylight of any method yet devised. It is "efficiency personified" and our fixtures harmonize with every style of architecture.

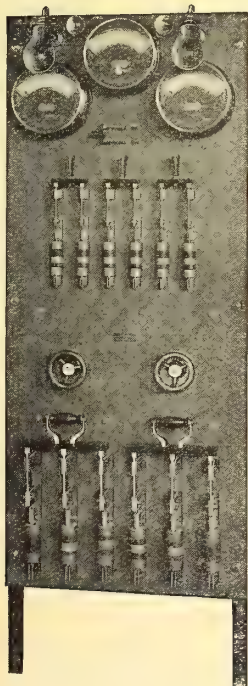
Our new booklets and data will be of especial interest to Central Stations and Dealers. We deal through the electrical trade only.

National X-Ray Reflector Co.

214 Jackson Blvd., CHICAGO

Worcester Electric & Mfg. Co.

WORCESTER, MASS., U. S. A.



A. C. and D. C.

Switchboards

SWITCHBOARDS, PANELBOARDS, FUSE BLOCKS, KNIFE SWITCHES,
AUTOMATIC BATTERY SWITCHES, ELECTRICAL
INSTRUMENTS, STORAGE BATTERIES

Our Catalogue No. 8, will interest, it shows why "Worcester Made"
Electrical Apparatus are the Best.

Estimates and Designs Furnished on Request

MAIN OFFICES AND WORKS:
Worcester, Mass., U. S. A.

WESTERN CANADIAN REPRESENTATIVES:
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Monarch Electric Company, Limited

St. Lambert, P.Q.

DISTRICT MONTREAL

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Montreal Exchange



500 Amp. 6,000 Volt Automatic
Oil Circuit Breaker Laminated Con-
tacts Individual Oil Tanks. Can be equip-
ped for remote control.

We
manu-
facture

**Electrical
Specialties,
Switchboards,
Switches**

Special Transformers

and numerous other Electrical Ap-
pliances but space prohibits enlarging
on them in this issue.

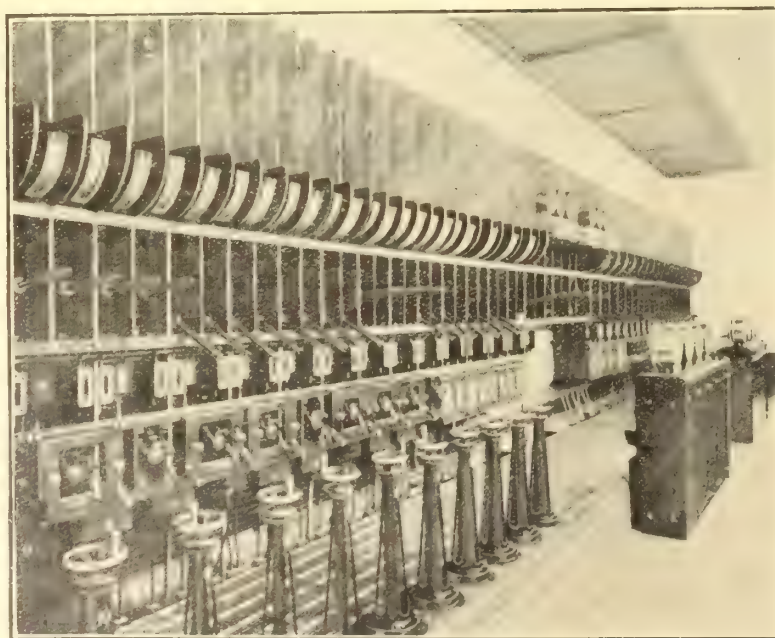
300 H.P. 2500 VOLT MOTOR STARTING EQUIPMENT



FERRANTI LIMITED

**ELECTRICAL and
GENERAL ENGINEERS**

Manufacturers
of
Complete
Switchboards
D. C. & A. C. up
to 60,000 Volts.
Transformers
Auto Starters
Switches
Circuit
Breakers, etc.



Reliable
Operation
Substantial
Construction
combined with
Accuracy
and
High Class
Finish

Canadian Representative

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If you are in the market for any kind of electrical equipment send us your specifications and let us quote you.

Bakelite

Impregnated Wood

WOOD, particularly porous woods such as poplar, basswood and maple, can be so impregnated with the famous product **BAKELITE** as to be rendered hard and resistant to chemical and physical influence.

BAKELITE impregnated wood has an exceedingly high uniform dielectric strength, this being produced through the well known insulating properties of **BAKELITE**.

The importance of this for use on high-tension lines and throughout electrical work in general is great as the strength of wood, thus treated is increased and becomes an excellent insulator of electricity, withstands moisture, chemical, solvents and is rot-proof. Where such wood has to be imbedded in cement or other conditions under which it is liable to attack from dry-rot, the advantages of the bakelized product are plain.

Afterwards if desired a beautiful high finish can be obtained with Bakelite Varnish, which resists the same actions as already mentioned.

We will give full information upon request of the many valuable uses to which bakelized wood can be put in electrical work. Write us.

Plastics Limited
Van Horne Street, Toronto

If Good Battery Service Interests You, Read This :

A truck, which has been operated for the past five years by G. E. Markley & Company, Commission Merchants, Cincinnati, Ohio, now contains its third set of Gould Batteries, upon the installation of which the owners wrote us as follows:

"We have given the new battery a good try-out and it is working to our entire satisfaction. While the General Electric Vehicle Company truck on which it is used is of four tons capacity, we do not hesitate to put on five and six tons when in a pinch. The batteries have always moved the load as we wished."

None but Gould Batteries could give such service. No other make of battery has ever demonstrated a higher degree of reliability or an annual maintenance cost so low.

Gould Batteries invariably give exceptional service because they are made in types exactly suited to the work to be done, and this is an advantage which only Gould Batteries possess. Our separate types of batteries, each with distinct economy characteristics, and for special application and service, are superior in their respective fields.



Investment in Gould Batteries buys more mileage than can be secured from any other. Tell us what battery equipment you now have, and we'll explain exactly how this applies to your conditions.

Gould Storage Battery Co.

General Offices: 341-347 Fifth Ave., NEW YORK

Works: DEPEW, N. Y.

BOSTON, 89 State St. CHICAGO, Rookery Bldg.

SAN FRANCISCO, Atlas Bldg.

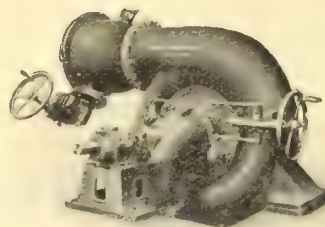
CLEVELAND, American Trust Bldg.

American Sewer Pipe Co.,
AKRON, OHIO.
Vitrified Conduit—Best Made



Among our Satisfied Customers are Cities of
Toronto, London, Calgary.
Ask Them.

Water Power Plant



Type 30 Francis Turbine
1000 B.H.P. 120 Feet Fall

Pipe Lines, Governors, etc.

Apply to

James C. Gordon & Co.

81 and 83 Knightrider Street
LONDON, - - ENGLAND

John Starr, Son & Co.

Limited
158 Granville St. - HALIFAX, N. S.

Electric Lighting Supplies

LAMPS, SOCKETS, ROSETTES, WIRES, CORDS,
CONDUIT, MOULDING, SWITCHES, CUT-
OUTS, FIXTURES, ETC., ETC.

Large Stocks - Prompt Shipments

Write Us for Low Prices

Messrs. Buyers in General,
ANYWHERE,
Canada.

Gentlemen:—

Are you aware that we stock sheet Fibre in sizes from .010 in to 1 in. and can fill your orders same day received for Fibres, Press-board, Leatheroid, Oiled Cambrics, Armature Tapes, Sterling Insulating Varnish, both Baking and Air Drying, besides, of course, a full line of Overhead Line Construction, Car Equipment, Building Wiring Supplies of all descriptions.

Your enquiries and orders entrusted to us will be subject to prompt and careful attention.

Yours to command,

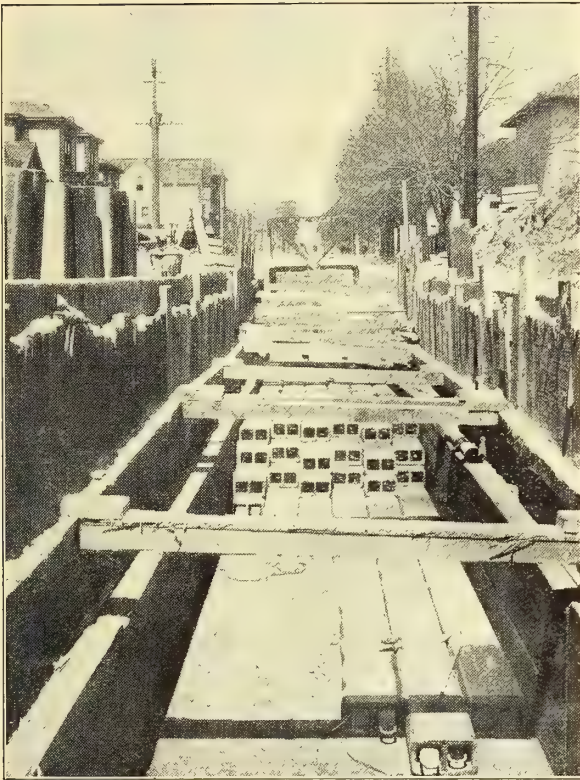
Dawson & Co., Limited

148 McGill St., MONTREAL

P. S.—We strive to make each and every sale its own advertisement for further business. Does that appeal to you, SIR?

WESTERN BRANCH:

56 Albert Street - Winnipeg, Man.

G. M. GEST**Conduit Engineer
and Contractor**

Electrical Underground Conduit Systems

When **G. M. GEST** designs and constructs your Conduit System you receive the benefit of many years' experience and specializing in that line of work.

Power Building, Montreal, P.Q.



BY the time these lines reach your eye we will have ready for distribution a HANDBOOK of the I-T-E CIRCUIT BREAKER. This is a combined TEXTBOOK on the use of circuit breakers and a PRICE LIST of our product which should be in the library of every Consulting and Operating Engineer.

We have been at work on this publication for more than two years, and have spared no pains or expense to make this work so authoritative that it will occupy the same position as a textbook that the I-T-E CIRCUIT BREAKER does in the electrical installation, the last word on the subject of protection.

THE CUTTER COMPANY

MAIN OFFICE AND FACTORY :
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The Cutter Company, 120 Liberty Street, New York City.
The Cutter Company, 1122 Park Building, Pittsburgh, Pa.
The Cutter Company, 751 Ellicott Square, Buffalo, N.Y.

Eccles & Smith Co., 524 S. Los Angeles St., Los Angeles, Cal.

Electric Manufacturers' Sales Company, Denver, Colo.

The Cutter Company, 1555 Monadnock Block, Chicago, Ill.

The Cutter Company, 1418 Ford Building, Detroit, Mich.

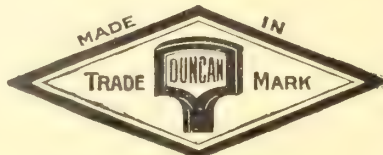
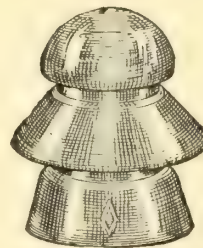
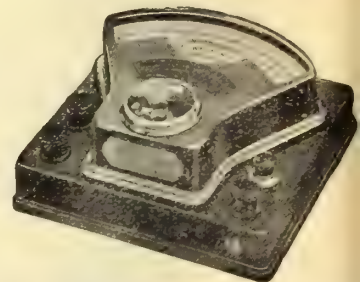
Eccles & Smith Co., 71 First Street, San Francisco, Cal.

Eccles & Smith Co., 68 First Street, Portland, Ore.

THESE TRADE ESTABLISHED STA



THE WIRE & CABLE COMPANY

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DUNCAN SOCKETS AND CUTOUTSDIAMOND GLASS
INSULATORSWESTON ELECTRICAL MEASURING
INSTRUMENTS

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TRADE MARK
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REGISTERED SEPTEMBER 11, 1894

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REGISTERED APRIL 2, 1901

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Each Trade-
Mark is Your
Guarantee of
Quality and
Economy



(Reg. U. S. Pat. Off.)

LORICATED AND
GALVADUCT CONDUITSKELETON AND ENCLOSED
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CUTOUT BOXES

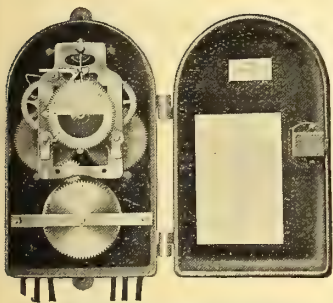
THE Northern

AND MANUFACT

MONTREAL TORONTO WINNIPEG

ADDRESS 0

MARKS DENOTE STANDARDS OF QUALITY



HARTFORD TIME SWITCHES

BROOKFIELD
STANDARD GLASS
INSULATORS

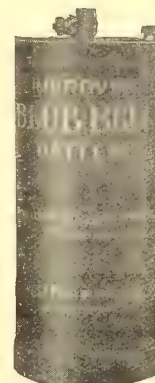
EDWARDS & CO., INC., HOUSE GOODS



THE WIRE & CABLE COMPANY

WARD LEONARD

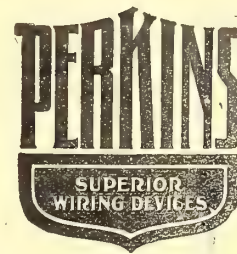
RHEOSTATS AND CONTROLLERS

"D & W" FUSES AND
CUTOUTSP. & B. INSULATING
COMPOUNDSCROUSE-HINDS
CONDULETS AND
PANEL BOARDSIMPROVED BLUE
BELL BATTERY

SERVICE

The Large As-
sorted Stocks
in Our Houses,
Allow Immed-
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on all Standard
Material

Inter-phones

MAZDA
LIGHTING FIXTURESHIGH AND LOW VOLTAGE
INSULATORS

(Reg. U. S. Pat. Off.)

Electric

URING CO. LIMITED



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REGINA

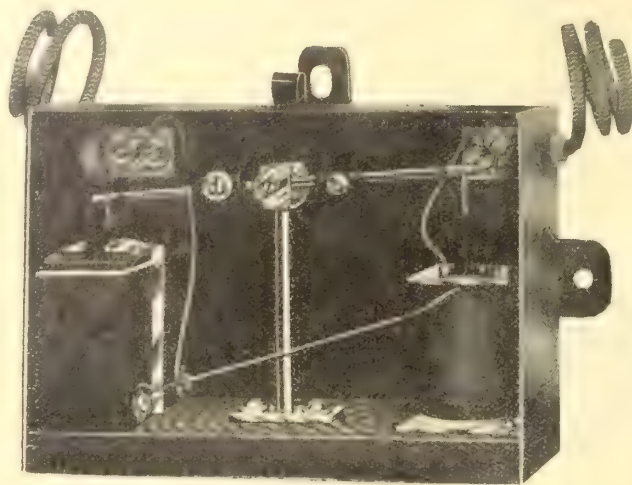
CALGARY

VANCOUVER

Overload Does Not Injure This Controller

THE SHEDRICK ELECTRIC LIGHT CONTROLLER OR LIMITER

Not Made
to
Last a Year
But a
Lifetime.



A
New
Departure
in
Controllers

Result of test of a ten light controller put in circuit with an overload of four lights (fourteen in all) with an average make and break of one hundred and twenty per minute (330,000 strokes)—more than any instrument would be subjected to in a lifetime—showed absolutely no injury in any way to Controller.

SATISFACTION GUARANTEED—WRITE TO-DAY FOR PRICES

Electric Specialties Manufacturing Company
157 Craig Street West, Montreal

C. & H. METERS

OUR A. C. METER has a higher torque and a higher ratio of torque to weight than any other A. C. Meter on the market.

It is supplied with ordinary or cyclometer counters as desired.

Ordinarily, it is supplied in a light cast-iron case which does away with stray-field errors, but it can be supplied in glass case if required.

It is made for any frequency, voltage, current and power factor and will maintain its accuracy even with considerable variation in any of these items.

Besides ordinary meters, we make Two-rate meters, Prepayment meters, Three-phase meters—in fact every sort of meter, not only A.C. but D.C. too.

TIME SWITCHES—We are also marketing the VENNERS Time Switches, with which we have been associated in the Old Country and the world generally for many years. They are the only switches that have ever received government approval.

Mr. Stanley Lines, our permanent resident director for Canada, will arrive in Toronto about the middle of January.

Write him in care of Electrical News, 220 King Street West, Toronto, until further notice.

**CHAMBERLAIN &
HOOKHAM, Ltd.**

Solar Works : BIRMINGHAM, ENGLAND

Cablegrams :— "Solar, Birmingham"

Codes : A. B. C. (5th Ed.), Western Union, Marconi, Private

ELECTRICAL WIRES & CABLES

FOR ALL PURPOSES

Weatherproof Insulated Copper, Iron and Aluminium.

Bare Copper and Aluminium Wires and Cables.

Copper Trolley Wire, Round, Grooved and Figure 8.

Rubber Covered Wires and Cables.

Galvanized Telegraph and Telephone Wire.

Galvanized Steel Strand for Guys.

Canada Wire & Cable Co.

1170 Dundas Street

Limited

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CANADA

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THEY WILL SURPRISE YOU



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Electrical Works, Berlin, Germany

Metal Filament

AND

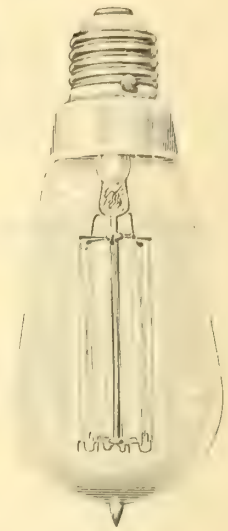
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Incandescent Lamps

Best in the World

PROMPT DELIVERIES

Direct from Stock in any Quantities



Exclusive Distributing Agents for Canada:

Look for the White
Porcelain Base

P. H. KLEIN Jr., CO.

329 Craig Street West - MONTREAL

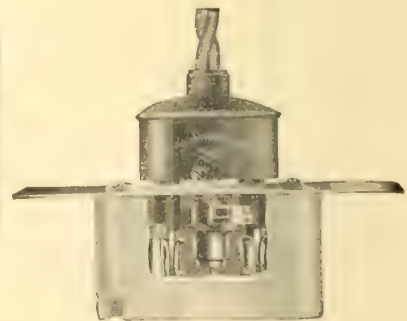
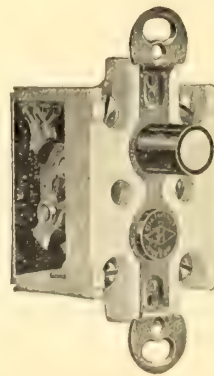
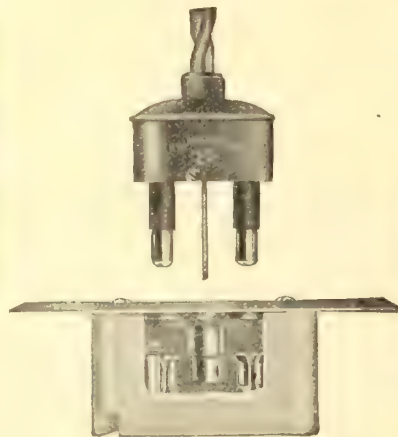
Auto and Battery
Tungsten Lamps

Protect Your Investment in Switches by Specifying "Diamond H"

The best protection for the user because they are dependable in operation. The safest investment for the dealer, engineer or contractor because they give satisfaction.



The "Diamond H" on a switch is valuable insurance—assurance that quality, materials and competent workmanship are embodied to perfect production.

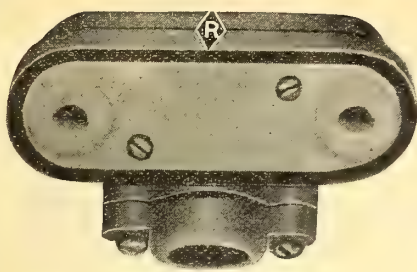


MANUFACTURED BY THE HART MANUFACTURING CO., HARTFORD, CONN.

Canadian Sales Agent:

C. W. Bongard, Toronto, Canada

CONDUIT FITTINGS



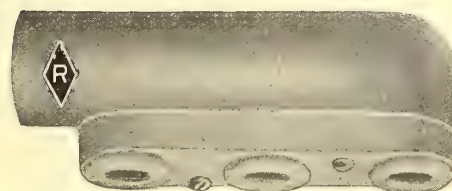
F 1/2"-2 Wire Cover



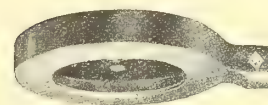
LB 1/2"-2 Wire Cover



A 1/2"-3 Wire Cover



E 1/2"-3 Wire Cover



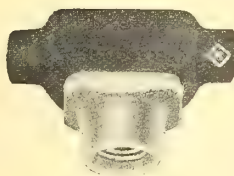
P 1/2"



1445-Reversible Guard



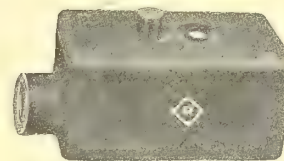
K 1/2" Plug



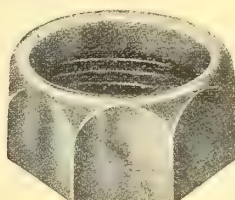
J 1/2" Receptacle



3/8" Fixture Stud



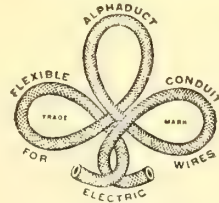
F D 1/2" Push Switch



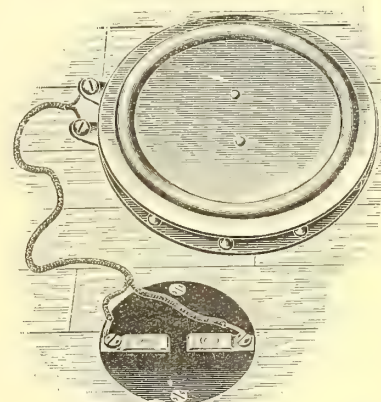
1/2" Bushing



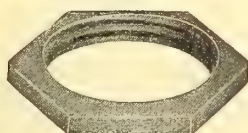
1/2" Pipe Strap



Alphaduct 1/4"



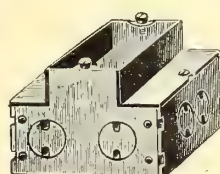
150-Floor Tread



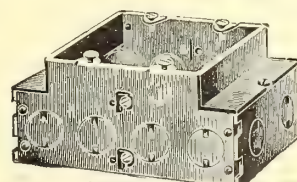
1/2" Locknut



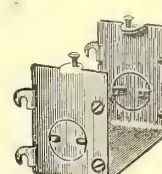
6350-Outlet or Junction Box



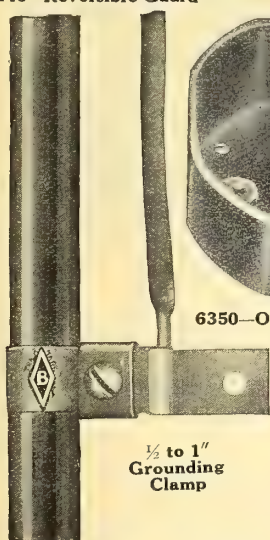
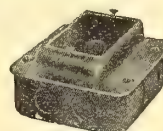
155-Switch Box



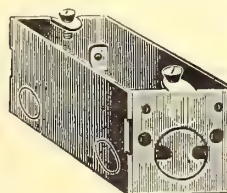
160-2 Gang Box



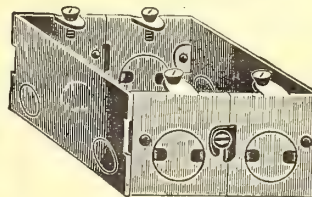
161-Spacer

1/2 to 1"
Grounding
Clamp

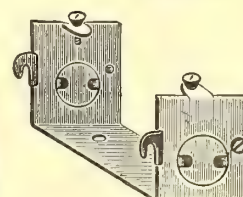
1915-Switch Box



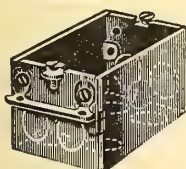
170-Comb Switch Box



172-2 Gang



171-Spacer



C C S. I. Switch Box

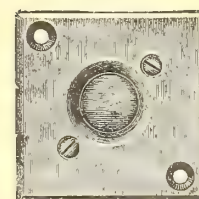
Electrical Fittings Co. Limited

70 King Street West, TORONTO, Canada

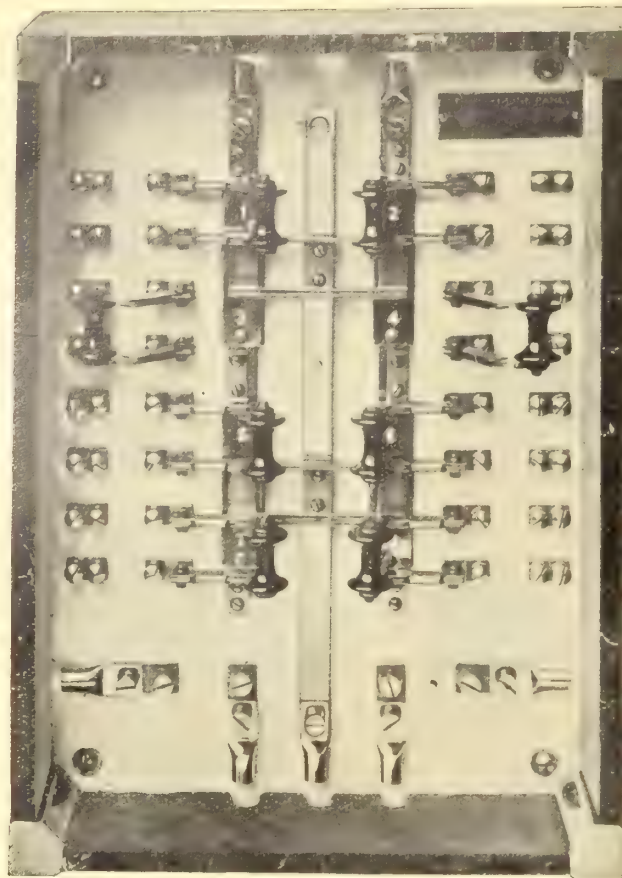
British Columbia Agents, Cope & Son Ltd, 132 Water St., Vancouver, B. C.

"Made in Canada"

Write for Catalogue No. 3. If your Jobber cannot supply, write us.



2685-Pearl Push



KRANTZ

Switch Boards and Panel Boards

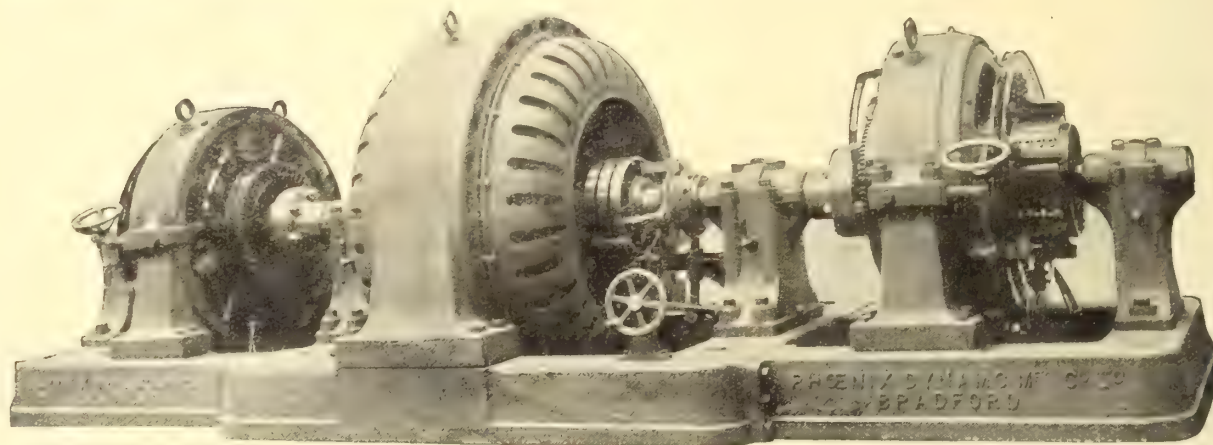
Are the make used in many of the largest institutions, office and government buildings in the United States and Canada.

The main switchboard of the New York Central is a Krantz.

WHY?

because they are the recognised leaders.

Send us your enquiries.



Heavy Current Boosters and Low Voltage Dynamos. Fitted with "Half Turn" winding. Sparkless on 50% Overload, ordinary Carbon Brushes.

The Phoenix Dynamo Manufacturing Co. Limited - Bradford, England

BRANCHES: London, Glasgow, Swansea, Birmingham, Newcastle, Australia, Russia, Japan, Canada.

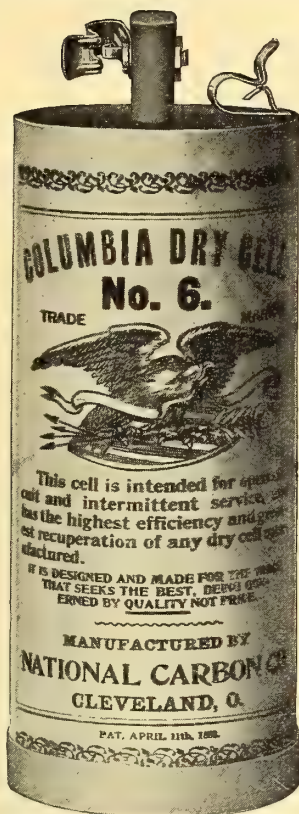
A LONG STANDING PROBLEM

The attention of Electrical Designers has for many years been focussed upon the production of a really satisfactory heavy current low voltage dynamo which should be free from electrical and mechanical troubles. The users of this type of machine in the past are, unfortunately, well acquainted with the constant trouble—due to the rapid wear of the brushes, overheating and blackening of commutators, sparking and flashing over with sudden overloads. The experienced station engineer is refusing, with growing conviction, the offer of a standard interpole machine with merely an "overgrown" commutator as a solution of this problem.

The successful heavy current Booster is a new class of machine, requiring new principles in its electrical and mechanical design. We claim to have solved this problem by means of our "Half-Turn" winding and the accompanying mechanical design of armature and commutator.

WRITE US FOR BULLETIN,

Canadian Agents, **The C. H. Keeler Co. Limited, Toronto, Ontario**



Have you ever thought of this?

Every maker of dry cells claims the Best Battery

Glance through the pages of this or any other magazine in which dry cell ads occur.

You will notice that every advertiser claims most for his particular brand.

Does it seem reasonable to you that all are best? Certainly not. How are you to judge? Here is a plan.

Study the history of the cells and the organization back of each. Make a test of those that seem best and you can then put your confidence in the one that wins out.

If you make a thorough investigation Columbia Dry Cell will win your order. It has been a leader for more than twenty years and still leads the list in international prestige, long life, reliability, economy, efficiency.

Our new factory at Toronto is growing already because of the confidence in Columbia batteries. We expect to enlarge it as rapidly as we can.

We will supply battery users with free samples for test if they are interested.

Address E-N-11

Canadian National Carbon Co., Ltd., 99 Paton Road, TORONTO, ONT

Heating With Exhaust Steam

The Most Profitable Load An Engine Carries

Many of you are manufacturing heat in the form of steam, but what becomes of it? You are simply converting 10 to 14 per cent. of it into mechanical energy in the form of electricity, and throwing the balance away, either into the atmosphere or into the condenser. The plant which operates non-condensing may have 10 per cent. heat efficiency and the condensing plant a possible 14 per cent. conversion.

Why Not Sell the Larger Amount of the Otherwise Lost Energy

You can get a price for it which will pay the total fuel bill of the plant, including also such other expenses as water, oil, etc.

CAN IT BE DONE? YES!

Others are not only doing that very thing, but are also earning interest and depreciation on the cost of the steam installation.

*We not only Make Reports and Build Central Station Plants,
but Solicit Business and Manage Such Plants, if Required.*

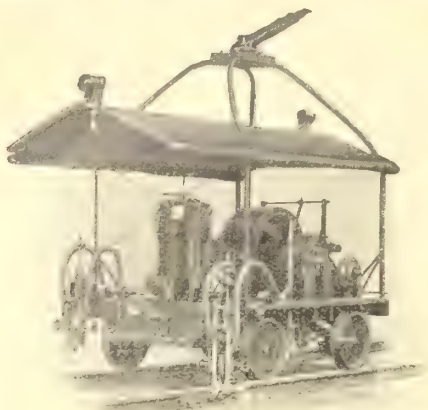
Why Not Take Advantage of Our Experience?

Central Station Heating & Construction Co.

714 Ellicott Square, BUFFALO, N. Y.

Canadian Office W. E. SKINNER LIMITED, Somerset Building, WINNIPEG

Electric Weld Rail Bonds



The conductivity of Bonds installed by our process can never be impaired by moisture or corrosion.

When once installed, they are on to stay and cannot be removed without actual mutilation and considerable hard work.

Write for Booklet

The

Electric Railway Improvement Co.

Office and Works, 6005 Carnegie Avenue
CLEVELAND

"BRAIDUCT"

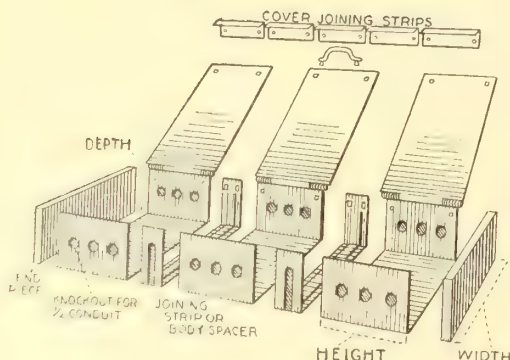
The indestructable flexible conduit is being specified by the progressive contractors throughout Canada from the Atlantic to the Pacific, because they have found it superior under all tests; it is moisture, weather and flame proof; quickly and easily installed; will not crack in zero weather and the cost is no more than for the rest.

Order through the leading jobbers or direct.

The Flexible Conduit Co., Limited

Guelph, Ontario, Canada

COLUMBIA BOXES



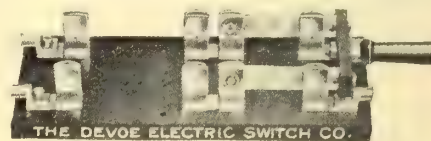
With this system of "Enny-Size" box it is unnecessary to keep a large stock of various sized boxes. Just keep a small supply of "Enny-Size" parts and make up your different sizes as you require them.

Columbia Metal Box Co.

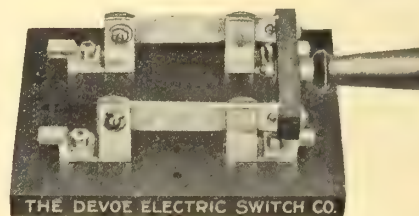
Northern Electric Manufacturing Co. Ltd.
Distributing Agents for Canada

DEVOE

The constant increasing sales of the Devoe Switches is a proof that they are giving satisfaction. If you are not using Devoe Switches begin at once. All our Switches from 25 to 200 ampere are neatly packed in Cardboard Boxes and the others are well parcelled and labelled ready for shipping.



Catalogue No. 2144, fused on Hinge End



Catalogue No. 3123

The Devoe Electric Switch Company

OFFICE AND FACTORY
157 Craig St. West MONTREAL, QUE.



SOME FRANK CHAPTERS

Insulator "Efficiency"

Insulator efficiency is **predicted** by personal judgment and interpretation of data in the determination of which many variables enter but the all important item of operating conditions does not and cannot enter.

Insulator efficiency is **determined** exactly the same as John Bull determines the efficiency of his battle ships—pull them out in the open and put them under gun-fire. Those that stand up are efficient ; those that fail are inefficient.

Efficiency in the abstract is fascinating ; work-a-day efficiency, the economical and reliable application of materials to the commercial problem, is quite another thing, but the important thing in high voltage insulators.

There are fifteen years experience back of "Victor" Insulators. They are valuable because of the mistakes they avoid.

THE LOCKE INSULATOR MFG. CO., Victor, N.Y.

OR

Engineering Equipment & Supply Company

410 St. James Street,
MONTREAL, QUE.



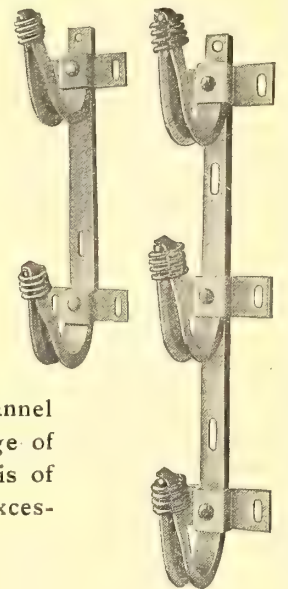
Peirce Brackets

These Service Wire Brackets are saving much in first cost and future up-keep for the Central Stations of the United States and Canada. Toronto and Winnipeg use them exclusively. Forty other Canadian Cities and over four hundred of the principal cities of the United States do likewise.

Peirce Brackets cost more in your warehouse but less on your patrons' buildings than other brackets. They are hot galvanized and made of hot rolled channel steel. The insulator springs are resilient spiral springs, which prevent the breakage of insulators. They allow for the inequalities of insulator bores. This resilient thread is of especial importance in Northern latitudes where wide ranges of temperature cause excessive expansion and contraction of cast iron brackets.

Our Catalogue Lists Sixty Different Styles

May we send you circulars showing why these brackets cost you less put up than unsightly cast iron brackets?



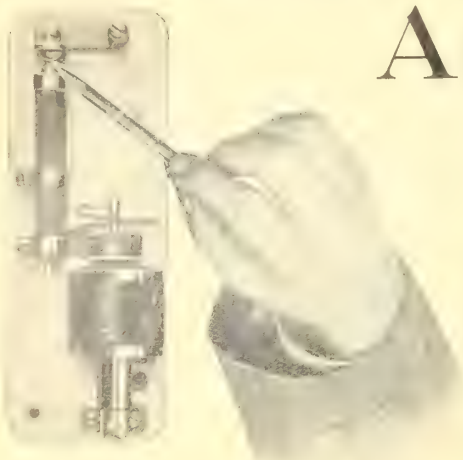
HUBBARD & CO.

PITTSBURGH, PA.

The World's largest manufacturers of Pole Line Hardware



Do This — A Simple Lightning Arrestor Test



Don't risk damage of your expensive electrical machinery from lightning. Even if it is already protected with lightning arresters, test them; it will pay you big to do so.

If they're

Garton-Daniels Lightning Arresters

test them as shown in cut. With this simple test, you **KNOW** that your arresters and grounds are in first class condition, and that you will then get the most efficient protection from them.

And Garton-Daniels Lightning Arresters do offer protection simply because of these points:—

The discharge path from line to ground contains only a small air gap and a low series resistance. These alone mean protection.

The low resistance eliminates surges and other voltage disturbances on your system at the time the arrester discharges.

The plunger circuit breaker gives a positive cut off of the flow of line current following the discharge to ground, so making grounds, short-circuits and similar troubles next to impossible.

Complete protection—your apparatus, your lines, your customers.

Let us send you our 1912 Catalog soon to be issued.

Garton-Daniels Lightning Arresters are handled by jobbers generally throughout the Dominion of Canada.

Test Garton-Daniels D.C. Arresters by sticking the point of a pencil momentarily in the air gap. Test A.C. Arresters on hot wires by first raising the plunger with a stick, placing small pieces of tin foil in the gaps, then allowing the plunger to fall.

Note the quick, snappy plunger action that follows when both Arrester and ground are in good condition.

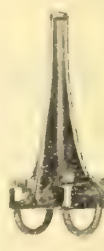
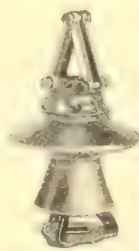
Electric Service Supplies Co.

Railway Material and Electrical Supplies

PHILADELPHIA
17th & Cambria Sts.

NEW YORK
Hudson Terminal

CHICAGO
417 S. Dearborn St



GUARANTEED FOR 5 YEARS!

ALL CABLE END BELLS

CABLE TERMINALS

(WIT TEST
2 1/2 TIMES)

(74 Types)

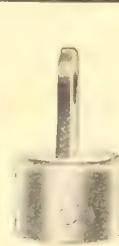
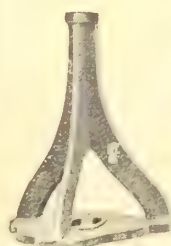
CABLE POTHEADS

Equipped with Patent Ground Clamp Device. No expensive wiping of joints. Will eliminate all break downs and outages. Can ship from stock. Send for Catalogues. All bells shipped with filling compound. Bus bar supports for all voltages for round or flat bus. Malleable pins, wall tubes, roof bushings, air and floor boxes. Malleable switchboard and pipe frame fittings. **NOTICE**—We own Canadian Patents No. 126336 and No. 131114 covering all applications of cable bells or potheads.

ELECTRICAL ENGINEERS EQUIPMENT CO.

POWER HOUSE SPECIALISTS.

10-12 N. DES PLAINES STREET, CHICAGO, ILL.



Electrical News

Generation, Transmission and Application of Electricity

PUBLISHED MONTHLY BY

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THOMAS S. YOUNG, General Manager.

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Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Correspondence is invited upon all topics coming legitimately within the scope of this journal. Subscribers can materially assist by sending in news items and information regarding electrical development in all parts of Canada.

Vol. 21

Toronto, February, 1912

No. 2

The Trent Valley Situation

For some time negotiations have been carried on between interests controlling The Electric Power Company, operating in the Trent Valley Canal district and the Ontario Hydro-electric Power Commission with a view to the latter acquiring the plants and interests of the private company.

The Electric Power Company is a corporation which controls practically all the plants for the generation and distribution of power in Central Ontario, reaching Lindsay on the northwest, Oshawa on the southwest, and Napanee on the east, having a practical monopoly of electric power distribution in the towns named and in Bowmanville, Cobourg, Port Hope, Peterborough, Belleville, Trenton, Brighton, Campbellford, Colborne, Tweed and other towns and villages. The requirements of this district are very different from those of a compact population in any large city such as Toronto or Ottawa. The customers are scattered through a number of towns, a few hundred horse power being taken in one place, a few hundred in another place, and so on. To build transmission lines to connect all these scattered places is very expensive, and it is reasonable that the interests of the entire district would be best served by having one system which would supply all; for, to duplicate the transmission lines and sub-stations, would increase the cost needlessly.

The amount of power which can be used in any one town is a large factor in determining the cost at which that town can be supplied. If, for example, the case of a town which can use five hundred horse power is taken, it

is evident that that power can be supplied more cheaply in one block of five hundred by one company than in two blocks of two hundred and fifty each by two companies, with duplicate plants. At present this field is served by the Electric Power Company, which reaches practically every town in the district, and which, moreover, has the decided advantage of owning a number of separate generating stations and having their lines so tied together that if anything should go wrong at one generating station, the others can supply power to the whole system without delay or inconvenience to the public. This company, moreover, has been charging very low rates, which cannot, we believe, be bettered by the Hydro-Electric Commission, and the public throughout the district are well satisfied. The company have expressed entire willingness to allow their rates to be subject to regulation by the Hydro-Electric Commission itself. The franchise in Peterboro, for instance, requires that the rates may be readjusted every five years, and the Electric Power Company is perfectly content to allow the rates which it may charge, to be regulated in the way stated. The Hydro-electric Commission, however, does not favor this policy of regulation, but proposes to extend its system to Central Ontario in the same way as it has done in Western Ontario.

The shareholders of the Electric Power Company, apparently have no desire to block the policy of the Hydro-electric Commission. They recognize that the interests of the district can be best served by one system, and if the Hydro-electric Commission is not willing that the company should be the distributors, subject to regulation of its rates, they are willing that the company should sell out to the Hydro-electric Commission, and let it be the sole distributor. Preliminary negotiations to this end have been undertaken, but nothing definite has yet been done. The representatives of the company have expressed a willingness to sell on fair and reasonable terms, and consider that the best way of deciding what would be fair and reasonable can best be settled by arbitration, one arbitrator to be chosen by the Hydro Commission, one by the Electric Power Company, and these two to agree upon a third. This commission of experts could examine the property and books of the company, and decide what, in their judgment, would be a fair price, and whatever their decision is, the owners of the Electric Power Company, we understand, pledge themselves to accept. The absolute fairness of this proposition can hardly be questioned.

Even if the Commission decides to go ahead with development work at dams Nos. 4 and 8, there are two factors to remember. In the first place, the amount of power which can be developed there is only seven or eight thousand horse power, which amount will not begin to supply the demands of Central Ontario, and would in fact soon be absorbed in Peterboro and the northern towns, leaving the rest of the country unsupplied by the Hydro Commission. The Electric Power Company is already selling fifteen thousand horse power, and has about sixteen thousand horse power more in process of development.

The second point is, that construction work at the dams from which the Commission would derive its power, has not been yet commenced, and at best, therefore, it will be two years before the Commission could supply power. It may of course use energy temporarily from the Otonabee company's present dam, if it should expropriate that system, but the whole of the output of the Otonabee plant is already sold to customers in Peterboro, so that there would be no practical gain. Competition from the Hydro-electric Commission is therefore practically impossible until at least two years have elapsed. The Electric Power Company is

strongly entrenched, and its position will certainly not become weaker during the next two years.

Considering the modern and substantial construction of the Electric Power Company's system, their facilities for providing continuity of service, their recognized fair treatment of the municipalities they serve, their willingness to arbitrate the sale of their entire equipment and not least, their ability to hold their own in any kind of fair competition the Commission can institute against them we believe the Government would be entirely ill-advised in expending large sums of the province's money in a duplicate system.

Bad Business Form

We occasionally hear complaints from manufacturers and others who deal in electrical apparatus that they do not receive fair treatment when tendering for supplies for municipal or other work in Canada. We are just in receipt of a letter from one of these stating that on a recent occasion, following the submission of a tender for the supplies required, further and confidential information was asked after the contracts were let—this latter fact being kept secret, at least from this particular tenderer.

This firm (from the United States, by the way) claim that they will not again tender for Canadian business, and our municipalities and private companies in general thus lose the benefit of this much healthy competition. Further than this, we are of the opinion that such practices are not in accord with the most approved business methods of the present century and, quite apart from the moral side of the question, will in many ways tend to retard the progress of electrical operations in our Dominion. That these negotiations were in charge of a recognized electrical engineer intensifies rather than condones the objectionableness of such a course. Professional self-respect, we think, should be sufficiently strong to render any engineer superior to the pursuit of a line of action that smacks of sharp practice.

Successful Annual Dinner

The Engineering Society of the Applied Science Department of the University of Toronto held its 23rd annual dinner on January 18th in Convocation Hall. The attendance was large and most representative from an engineering and manufacturing point of view. A special feature was the presence of a representative of the Commission of Conservation, Mr. M. M. J. Patton, who in the unavoidable absence of the chairman, the Hon. Clifford Sifton, outlined the scope and work and aspirations of the Commission along the general line of conservation of Canada's resources. Mr. Patton spoke at length on the decided progress made during the past year in the manufacture of peat fuel on a commercial basis and explained that not only was the price at which this fuel could be retailed in Ottawa now able to compete with anthracite coal, but also explained that they had been able, at the experimental station, to operate a 60 h.p. producer gas engine very economically, using peat fuel instead of coal. Mr. Patton further dwelt at length on the necessity of prevention of the present tremendous fire losses throughout the Dominion. He attributed these losses to imperfect building construction which was the result of defective by-laws and defective inspection, and he suggested that the time appeared to be ripe for the provinces of the Dominion each to create a department of municipal affairs which might have power to regulate such problems. Mr. Patton further spoke of the necessity of electrical engineers doing all in their power to educate the public to a knowledge of the large resources of the Dominion, as well as to the necessity of and best means towards the conservation of the same.

Other speakers were Dr. Ellis, who replied for the University; Mr. W. F. Tye, who spoke for the engineering profession; Mr. J. B. Tyrrell, who, with Mr. Tye, was one of the earliest graduates from the Department of Applied Science; Mr. G. A. Guess, the newly appointed professor of metallurgy, and Dean Galbraith. Among the guests of the evening were noticed Messrs. P. W. Ellis, W. D. MacPherson, Prof. Coleman, P. W. Sothman, Dean Fernow, Dr. Hastings, C. H. Mitchell, A. L. Mudge, H. B. Dwight and many others.

Send In Your Ideas

There are doubtless a number of good ideas on central station advertising and methods of encouraging the further use of electricity by their customers, which are being applied by various central station men throughout Canada, and inasmuch as a number of enquiries for just such ideas have come into this office recently the Electrical News offers to give due publicity to any original ideas which may be sent in and which would be helpful in encouraging the more extensive use of electricity and electrically operated devices. What we ask you to do is to co-operate with us and send in your ideas. If photographs or drawings are available and if they will assist in bringing out a new idea we shall be glad to reproduce them.

This is a matter which every central station manager or operator may well take to heart. If he is possessed of better ideas than others he can add much to the general good by giving these ideas publicity. If on the other hand he finds his load factor is not improving as he would like it to do or if he is unable to interest his customers to use more current all the time he is evidently in need of newer ideas. The distribution of constantly increasing quantities of electric energy is justifiable from every point of view. The central station manager should first become saturated with the belief that increased current consumption and industrial and commercial progress travel together, and he should next bend all his efforts to the conversion of his fellow citizens to the same point of view.

Automatic Load Regulation

We have given considerable space in our January and February issues to the question of load regulation by automatic battery boosters in reproducing a lengthy paper recently prepared for the Society of Civil Engineers of England. We were influenced in this by the wide interest that is being taken throughout Canada at the present time in the installation of boosters. When one reviews the storage battery situation in Canada it is surprising to observe the manner in which the results from storage batteries and boosters for automatic load regulation are being closely watched by electrical engineers. The number of installations throughout Canada is also a surprise. Much has been written with regard to fly-wheel driven sets for flattening the peak, but the booster type of equipment has thrust itself upon us as an economical solution of uneven conditions more especially where there is a rapid series of momentary overloads to be taken care of. Perhaps the cost of the apparatus in the past has been the chief obstacle in the way of its more common use, but considering the results it is doubtful if this is an obstacle which can long stand in the way of its more general adoption.

As illustrating the general use into which this type of apparatus has come in Canada in the last few years we cite the following Canadian installations:—City of St. Thomas, one Lancashire booster; B. C. E. R., one Lancashire booster; Montreal Street Railway, three shunt regulating Entz

boosters, with carbon regulators; Toronto Street Railway, two shunt regulating Entz boosters, with carbon regulators; Quebec Street Railway, one shunt regulating Entz booster with carbon regulator; Michigan Central Railway, Welland Canal Bridge, one regulating constant current induction motor driven booster; Ottawa Street Railway, one differential type booster; Bank of Hamilton, Hamilton, one regulating constant current set; Lloydminster Electric Light Company, one constant current booster.

It is seen that most of the installations are in connection with street railway service. This apparatus, however, is suitable for any condition where the changes in load are rapid and of comparatively short duration.

Mineral Production of Canada

A general summary of the mineral production of Canada during the year 1910 has just been issued by the Department of Mines, Ottawa, by Mr. Jno. McLeish, B.A., chief of the division of Mineral Resources and Statistics. The sections referring to copper and aluminum are of interest.

The copper production contained in blister, matte or ore (which was practically all exported) was 55,692,369 pounds as compared with 52,493,863 pounds in 1909, an increase of about 6 per cent. The exports were reported as 56,964,127 pounds, valued at \$5,840,553. The imports of copper were valued at \$4,369,773, which included crude and manufactured copper to the extent of 30,237,106 pounds, valued at \$4,219,451.

Four provinces of Canada contributed to the copper production,—Quebec 877,347 pounds, Ontario 19,259,016 pounds, British Columbia 35,270,006 pounds, the Yukon 286,000 pounds.

The average New York price of copper for the year is given at 12.738c. This compares with 12.982c. in 1909, 13.208c. in 1908, 20.004c. in 1907, 19.278c. in 1906. It will be seen that copper was cheaper on the average during 1910 than during any previous year.

In aluminum, imports to the value of \$471,924 were utilized at the plant of the Northern Aluminum Company at Shawinigan Falls, Que. Bauxite is the only mineral at present in commercial use for the production of aluminum and this has not yet been found in Canada.

Free Current for One Year

The Electrician of December 22 publishes an article descriptive of a system of central station operation being tried out in Strassburg, known as the Free-Current-For-One-Year-System. The operation of this principle is reported to be meeting with highly satisfactory results. Details are briefly as follows: To every consumer who wires his house at his own expense free current is supplied until the cost of the current so supplied equals the cost of wiring. The time of such free supply is, however, limited to one year and is made subject to the following conditions:

1. That no electrical installation in the rooms in question had previously been connected to the supply mains.
2. That the new installation must have its own meter.
3. That the cost of the installation to which free current is to be supplied does not exceed a given amount.
4. That a minimum revenue of a certain sum (about \$1.40) per lamp, or about 4 times this amount per motor, for the following year be guaranteed to the central station. This is intended to insure to the station that the actual cost of the free current is covered.

Such an installation immediately becomes the property of the owner of the house who is obliged to maintain it in good condition for at least 5 years. The new installations are carried out exclusively by private wiring contractors. It has been found the best way in practice for the house-

holders to obtain a tender for the work from a wiring contractor and then submit it for approval to the operating company to see whether they are willing to supply free current to the amount required in the tender. The householder then makes his own arrangement with the contractor.

It is claimed that this plan is favorable to the central station in two important points. The householder generally pays for his installation in monthly or quarterly payments which are larger than his current bill would be and so, starting in with the second year, he is agreeably surprised to find that his bills get smaller and is naturally induced to relax somewhat in vigilance and allow them to increase in size. Also since he gets all the current he cares to use for one year for absolutely nothing, he is pretty certain to use it with great freedom and is almost certain to continue to use it with more than average freedom during the second and following years.

The system is reported to have worked out well in Strassburg. By the end of the second year it is calculated that the revenue will be higher than under the ordinary rate of increase and that by the end of the third year the company will have more than made up what it has lost and will, in addition, have established its customers on a much larger consumption basis.

Mr Gest on Underground Conduit Work.

The subject of underground conduit work has been given much added interest by the recent lectures of Mr. Guy M. Gest, first before the electrical section of the Canadian Society of Civil Engineers at Montreal and later before the Toronto section of the A. I. E. E. Mr. Gest speaks with authority born of an evident close study of the underlying principles of the subject no less than by his wide practical experience during many years of actual installation work.

The historical side of the lecture was a surprise to most of his hearers. Mr. Gest was able to show that underground construction for electric wires was suggested as early as 1767. The idea of a practical application of the principle did not meet with acceptance, however, until 1881, when the city of London, England, took up the question, and during the following year installed several miles of underground work. The expense of such an installation, coupled, no doubt, with the fact that the need of the removal of overhead construction had not then reached anything like the critical stage of the present time, prevented its becoming general practice until early in the present century. During the past ten years advances both in the quantity and quality of underground conduit work have been phenomenal.

Mr. Gest laid particular emphasis on the necessity of separating groups of wires carrying different voltages. The approved plan is by stout concrete vertical walls. This was well brought out by one of the lantern slides which showed three groups of conduits being laid, each in its own separate compartment, the compartments being separated by walls of concrete. The opinion was also expressed by the writer that single duct conduit was often preferable to multiple duct and especially in electric light service distribution. He did not agree with the common European practice of making the duct joints watertight, but said the conduits should be so installed as to drain to the manholes.

The lecture was splendidly illustrated, chiefly by moving pictures. Actual installation work in progress in both England and the United States was shown. The opinion one would gather from the specimens shown would be that American practice is somewhat superior to European from the point of view of both scientific and substantial workmanship.

Messrs. Sothman, Kemble and Richards contributed to the discussion. Mr. Richards suggested the necessity of

some less expensive form of underground construction before its adoption could become general. Mr. Sothman spoke in favor of installing ducts watertight and having pressure tests made in all cases. He also favored square section duct units as being less likely to injure the insulation as the cables are being drawn. Mr. Sothman also spoke strongly in favor of exposed fuse boxes.

It may be added that though Mr. Gest calls himself a contractor his attitude towards his work is decidedly that of the engineer. The best method of installing underground conduit is evidently a prime consideration with him. The problem of electrical distribution in the years to come is indeed hopeful of solution when the contractor looks upon himself and seeks to make himself a scientific engineer.

Mr. Gest was accompanied on his Montreal and Toronto trips by his commercial engineer, Mr. H. H. Stannard, a genial personality well known throughout the Dominion.

The Canadian Peat Journal

The first issue of the first volume of the Journal of the Canadian Peat Society which will be published quarterly in future has just been received. The number contains much matter of value to those interested in the conservation of Canada's fuel resources. Papers are reproduced describing peat production by different methods and also a paper on power production using peat in a producer gas equipment in something the same way as anthracite coal is generally used.

In this latter paper which is presented by Mr. B. F. Haanel, B.Sc., chief engineer division of fuel and fuel testing, Department of Mines, Canada, some interesting figures are given on an experimental 60 h.p. Korting peat gas producer installed at the government fuel testing station, Ottawa. On the basis of a \$2 per ton rate for peat and \$4 for soft coal the fuel costs per brake horse-power year are calculated relatively as follows:

Peat producer gas plant, peat at \$2.00 per ton.....	\$ 7.50
Coal producer gas plant, coal at 4.00 per ton.....	9.00
Steam plant coal at 4.00 per ton.....	36.00

Renfrew Power Plant

The hydraulic generating station for supplying Renfrew with electrical energy is now nearing completion and Mr. J. B. McRae, the consulting engineer for the project, expects that it will be ready for operation early in the coming summer. The concrete work on the spillway and forebay is finished but work on the power house itself has been held up by the cold weather.

At present the pump house is being used as a generating station, there having been installed in it two 250 kw. generators driven by two 290 h.p. Belliss & Morcom compound engines. On the completion of the hydraulic station, these units will be moved into it. Each generator will then be direct-connected in between an hydraulic turbine and one of the above-mentioned steam units. Lodel-Voith couplings will be used, so that the generator may be driven by steam, water or both combined. One exciter, placed between the units will be used, and so arranged that it may be driven from a pulley on the shaft of either unit.

The new power station will have an effective head of 36-38 ft. The inlet to forebay and penstocks will be of the curtain wall type, in order to minimize ice troubles. The plant is situated on the Bonnechere River, and as the Hydro-Electric Commission is building a storage dam at Round Lake, some distance farther up this stream, it is expected that no trouble on the score of low water will be experienced.

First 110,000 Volt Line in Europe

Recent issues of the *Elektrotechnische Zeitschrift*, published in Berlin, describe the first 110,000 volt line ever put in service on the continent of Europe. The generators consist of three 5,000 kw. units of the high pressure steam turbo-generator type, generating at 5,000 volts, which is stepped up to 110,000 volts and transmitted along a steel tower line a little over 30 miles. The plant and distributing line is situated at Saxony. Two of the generating sets were installed by the Allgemeinen Electricitats-Gesellschaft. The third generator was installed by the Siemens-Schuckert Company.

The line conductors are electrolytic copper hard drawn with a cross section of 42 sq. mm. (25 millimeters=approximately 1 inch). The wire is 7 strand, each strand having a cross section of 6 sq. mm.

The design of the tower is shown in Fig. 1. It will be seen that the construction is quite unlike Canadian or United States practice. Instead of 3 cross arms to each of which a suspension insulator is attached, the upper cross arm is extended on each side and bent over, giving the re-

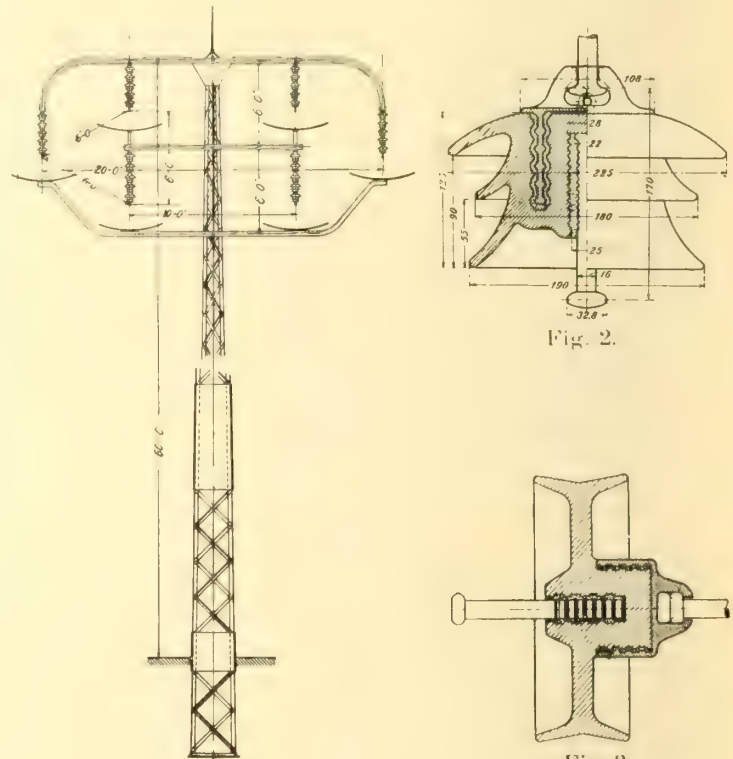


Fig. 1.

Fig. 3.

quired distance between the three conductors. A noticeable feature also is the metal guard under each of the conductors. The dimensions of the tower are shown. Along the peak of the tower line a grounded steel cable runs for lightning protection. This cable is 50 sq. mm. in cross section, it being considered that a heavy wire would assist in strengthening the tower line.

The insulator units are shown in Figs. 2 and 3, the dimensions given in Fig. 2 referring to mm. Fig. 2 shows the type of suspension insulator installed, 5 of these units constituting a complete insulator. Figure 3 represents the type of strain insulator installed. Six of these elements constitute a complete insulator.

All transformers and high tension switch-gear on this system were built and installed by the Siemens-Schuckert Company. The same company also constructed the transmission line.

Resuscitation Methods

Several months ago the National Electric Light Association brought together representatives of various engineering societies and government departments to consider the best means of furthering investigations into the study of the best means of resuscitation in case of electrical accidents. After full discussion it was determined to leave the formation of a committee to the American Medical Association. This body has now reported its choice of members for this committee.

It is understood the committee will begin active work at once. The National Electric Light Association undertakes to meet all expenses incurred in the investigation. The National Bureau of Standards is co-operating with the N. E. L. A. in this work, and undertakes the distribution to the general public of the final findings of the committee.

Auxiliary Plant of W. E. Ry. Co.

The recent completion of the new steam auxiliary plant for the Winnipeg Electric Railway, makes what is said to be a record for speed in the design and erection of a plant of its size and characteristics, some of which will be noted in the following brief description. There are at present installed ten Babcock and Wilcox boilers each with a 675 boiler horse power rating. Five of these are operating at present with the others not yet quite completed. These are equipped with Foster superheaters and Roney stokers. A link-belt coal conveyor system of the most modern design is installed, and the coal is dumped into a reinforced concrete bunker over the firing aisle between the two rows of boilers. Steel spouts with clam shell gates carry the coal into the stoker hoppers. Three Curtis single stage steam turbine driven, centrifugal boiler feed pumps are installed.

The generating equipment comprises three 3000 kw. Curtis six stage horizontal type turbo-generator sets. These have however a continuous rating of 4000 kw. Cooling air is brought from outside through sheet iron ducts to the bottom of the generators and at the winter air temperatures at the times when these machines are required, there is practically no heating when the machines are running at 4000 kw. Three 50 kw. 110 volt exciters are installed. These are each driven by single stage Curtis turbines at a speed of 3600 r.p.m.

The condensing equipment consists of three Wheeler surface condensers with Wheeler reciprocating engine-driven air pumps and three turbine circulating pumps driven by Kerr steam turbines. Two of the sets of condenser apparatus are of sufficient capacity to care for the exhaust from all the turbines at maximum output. All of the turbine pumps above noted are of Canada Foundry manufacture. Cochrane automatic release valves are provided on each of the turbines for exhausting into the atmosphere in case condensing apparatus fails.

An eight-panel black finished slate switch-board mounted on a gallery at one end of the station and opening onto the switching gallery of the adjoining sub-station controls the electrical apparatus. The oil switches, turbine governors, and generator field switches and rheostats are remote controlled, electrically operated. A Tirrill regulator is used for maintaining a constant voltage on the bus-bars. As the bus-bars tie in at the tie switch in the center of the sub-station bus-bars, no change was necessary in the old bus-bars to care for the additional 12000 kw.

The stack is of reinforced concrete, and is 250 feet high above the grade and 6 below the grade with a total height of 256 feet and a spread foundation 35 feet square and 5 feet 6 inches thick at the base. It is 24 feet in diameter at the bottom and 14 feet outside diameter at the top. This is believed to be the tallest stack in Canada, and the erection time was considerably shorter than usual in this

class of work, the daily average being 6 feet 4 inches, including three days during which work was suspended owing to an accident to the erecting superintendent. The first conference regarding the advisability of erecting this plant was held in December 1910 and tenders were called for in February 1911. A large amount of excavating and concrete work was necessary for the intake and discharge tunnels for the condensing and boiler feed water, and for the foundations. On December 16th the plant was placed in operation, practically all of the machinery, piping, etc., having been installed since the first of September. A more detailed account of this plant will follow in a later issue.

Winnipeg's New Engineer

Mr. J. G. Glassco has just been appointed engineer in charge of the power construction department for the city of Winnipeg's municipal system, replacing the engineering firm of Smith, Kerry and Chace who relinquished that office on January 1st. Mr. Glassco was born in Hamilton, Ont., and is a graduate of McGill University with both Bachelor and Master Degrees. After leaving McGill he was 2 years in the testing department of the Montreal Light, Heat and Power Co., and the two following years in Los Angeles with the Edison Electric Co., as chief operator of their 60,000 volt hydro-electric system. The next 4 years he was with the Dominion Power and Transmission Co., as electrical engineer and for the last three years has been in Winnipeg on the design and construction of the municipal plant.



Mr. J. G. Glassco

Montreal's 1,000,000 H. P. Proposition

Announcement is made in Montreal of a much more comprehensive water development scheme at the Coteau and Cedar Rapids than was at first proposed. The present plan would divert the entire St. Lawrence River, with the exception of a small fraction which supplies the Canadian Light & Power Company by way of the Beauharnois Canal, to the north of its present course and empty it into the Ottawa River opposite Isle Perrot. The intake would be at Lake St. Francis. The difference in level between these two points is about 85 feet. The plans place the dam and power house right at the Ottawa River end of the new water course. The diversion of the St. Lawrence in this way would cut out both the Coteau and Cedar Rapids. Apparently the plan proposes by a high dam at the discharge end to back the water up to the Lake St. Francis level creating a twelve mile stretch of still water. Navigation would be provided for by a high lock at one side of the power house.

This proposition is being put forward by the Eastern Canada Power Company which is said to be composed of Sir Max Aitken and other prominent Montreal financiers. The theoretical development under such a scheme would be in the neighborhood of 960,000 h.p. under an eight foot effective head.

During the past year the city of Westmount made a profit of \$4,758 on its electric lighting system.

We are indebted to Mr. H. D. Bayne, of the C. G. E. Co., Toronto, for an advance copy of his annual "Suggestions" for 1912.

The Makers of Electrical Canada—11

ORMOND HIGMAN — THE STANDARDIZER

The subject of our sketch this month, Mr. Ormond Higman, chief electrical engineer of the Electrical Standards Laboratory, Ottawa, is an Englishman, having been born in Cornwall. In 1864 Mr. Higman entered the service of the Electric and International Telegraph Company, at Liskeard, where he remained until 1869, at which time he decided to come to Canada and join the Montreal Telegraph Company. In 1873 he was made chief of the operating staff of this company at Ottawa, and at the same time manager of their sessional staff in the Canadian House of Commons. For the next nearly twenty years he continued in this capacity and at the same time acted as inspector of the Ottawa division for the Montreal Telegraph Company. In 1887, in addition to his other duties, he was offered and accepted the position of electric light inspector for the Ottawa district for the Canadian Fire Underwriters' Association.

By this time Mr. Higman's work was becoming well and favorably known throughout Canada, and in 1892 he was invited by the then Minister of Inland Revenue, the Hon. John Costigan, to draft a bill providing for the inspection of electric lighting installations on the lines of the Canadian Gas Inspection Act. This bill was ultimately adopted. In August, 1893, the Canadian Government dispatched Mr. Higman to Chicago, to represent the Dominion at the meeting of the International Congress of Electricians at the World's Fair in that city, and later a committee of the Congress selected him to represent the interests of British North America in the Chamber of Delegates consisting of the official delegates from the different governments of Europe and America to consider and adopt a system of units for electrical measurements. At the same meeting Mr. Higman was made a vice-president of the General Congress.

During the session of 1894 the Canadian Parliament was asked to consider two bills that had been prepared by Mr. Higman, one for legalizing the International units adopted at Chicago, the other dealing with the work of inspection. Both the bills became law and Mr. Higman received his appointment under the latter act. Since this date he has been chief electrical engineer to the Canadian Government and upon his shoulders has fallen most of the technical work incident to the administration of these acts. It will further be remembered that he represented the Canadian Government at the Electrical Congress at St. Louis in 1904, held in conjunction with the St. Louis Exposition, at the conference held in London in October, 1908, on the subject of electrical units and standards, and also at the International Congress

of Applied Electricity at Marseilles in the same year.

It is not generally known but is a matter of gratification not only to Mr. Higman himself but also to the government that appointed him, that in April, 1895, he was offered, but declined, the post of chief engineer for Queensland, Australia.

Mr. Higman is a member of the Institution of Electrical Engineers of Great Britain, a member of the Canadian Society of Civil Engineers, president of the Civil Service Association, and vice-president of the Canadian National Committee of the International Electro-Technical Commission. In connection with the widely recognized success of Mr. Higman's work for the government it may be stated that commissioners from the state of New York, and more recently from Japan, have

visited the Ottawa Laboratory and investigated the system there with a view to establishing similar systems in their own countries. Legislation at Albany has since been largely based on the Canadian law and Japan has now copied the Canadian Act and Regulations almost in their entirety. Further, the director of the Electrical Standards Laboratory of the Board of Trade in England recently investigated fully the Canadian system, and was only prevented from putting it into operation because of the peculiar individual powers of the British municipalities.

As an indication of the advance of the work of electrical standardization in Canada it is also recalled that a branch of the Ottawa Electrical Standards Laboratory is being established under Mr. Higman's

direct supervision at Vancouver, B. C. With his admirable admixture of practical, legal and administrative services, loyally devoted to the country of his adoption, few men can lay greater claim to the title "A Maker of Electrical Canada."

The Lindsley Brothers Company, Spokane, Washington, dealers in Idaho poles, have just installed a treating plant at their Priest River, Idaho, yard for the treatment of poles with Avenarius Carbolineum by the open tank process. The plant has a capacity of 300 poles a day, and the company has just completed the shipment of a large order of treated poles from this plant going to Colorado points. This plant makes the second one operated by the Lindsley Brothers Company, the other being located in Spokane. The company has recently completed the treatment of 40,000 ties for the Washington Water Power Company and has a number of contracts on file for spring delivery.



Mr. Ormond Higman

Underwriters' Requirements in Installation of Induction Motors

The Canadian Fire Underwriters' Association has sent out a bulletin with reference to their requirements governing the installation of induction motors as printed below. The proper installation of electrical apparatus is quite as important as the quality of the apparatus itself, in the insuring of uninterrupted service. It is not only the fact that fires may be started as the result of careless installation or inadequate protection that must be considered, but the additional factors of delay, reduced revenue, dissatisfied customers, &c. It is to be hoped the association will be given hearty co-operation in all such matters by all users of electrical apparatus.

"The attention of motor manufacturers, contractors and others interested is directed to the requirements governing the installation of induction motors and to the fact that they will be rigidly enforced.

Motors which have already been installed and may now be operating are not excluded and inspectors are instructed to report all cases where these motors are not installed in accordance with requirements set forth herein. These requirements are not new and have been accepted and regarded as necessary and are in keeping with the National Code rules.

This bulletin is, therefore, being circulated to advise all parties interested that motors should not be installed unless complying with these requirements, and that before using current a certificate of inspection and approval should be obtained from this association. Inspections will be made promptly upon receipt of customary application at this office.

1. Induction motors from 5-h.p. down, may be started without compensating devices; but they must have two sets of fuses on all sizes from this up and including 5-h.p. (The practice of merely throwing these motors on the line and depending on one set of fuses is not approved and will be classed as a defective installation. Owing to the abnormal current required in starting these motors, it is necessary to have fuses much above the rated current of the motor, so that unless protected with double fuses as described there is practically no protection to the motor under normal running conditions.)

2. Such motors should be provided with an approved triple pole double throw switch, and where the mains are already fused properly, the starting side may be connected direct to the circuit and the running side must be fused to protect the motor. (In dusty locations, such as woodworking establishments, flour mills or in the immediate neighborhood of inflammable material, these switches must be of some approved enclosed type.)

3. Cut-outs must be of an approved type and must not be filled or replaced with wire or anything but proper fuses, and should be of same capacity on each phase. (The practice of replacing blown fuses with copper wire is much more dangerous than is generally realized by power users and should not be permitted, and owners of buildings using motors should rigidly enforce this rule and hold their employees responsible if such rules are violated. It is not only a dangerous practice, but is very liable to completely destroy the motor, if nothing more serious results.)

4. Wiring to induction motors must be large enough to carry the starting current, but for starting current only may be rated according to wire table B, page 31, 1911 Code, but must be rubber-covered wire. (The motor leads or branch circuits must be designed to carry a current at least 25 per cent. greater than that for which the motor is rated. Where the wires under this rule would be over-

fused in order to provide for the starting current, as in the case of many of the alternating current motors, the wires must be of such a size as to be properly protected by these larger fuses.)

5. Double throw switches must in all cases be plainly marked showing in large, plain type, "starting," and "running" side. (Reference to triple pole switches is where 3-phase current is used. Where 2-phase is used, it must read 4-pole.)

6. Oil immersed ironclad auto starters are the most desirable form of starting device on sizes above $7\frac{1}{2}$ -h.p.; in dusty places and in the neighborhood of inflammable material auto starters with exposed switch-blade are not approved. (Motors started by such devices may, where the mains are already properly protected with fuses, be connected direct to same on the starting side, but must be fused to protect the motor under normal conditions on the running side. In laying out induction motor wiring, it is advisable to provide ample copper and keep the system of mains large and solid, so as to avoid a multiplicity of fuses, which would be required if branch circuits are of smaller capacity.)

Addenda.—It is strongly recommended, and in some locations double-throw switches and fuses may be required on motors under 5-h.p. An approved double-throw switch must be constructed so that it cannot be left on the starting position."

The Practical Value of Promoting a Higher Standard of Illumination

By Mr. C. A. Howe

So much has been said or presented through the columns of various periodicals on the above subject that it is difficult to write on the subject treating it as unexploited data or information. While the majority of the larger central stations have new business departments for advancing new business, or their contract departments, that are kindred to the former, in building up new and old business, it is surprising to observe how few apply the principles of illuminating engineering as a basis for building up the lighting end of their departments. They claim recognition of its value but they follow lines of least resistance in its application or adaptation to their conditions.

This same condition exists also with the contractor, who in wiring a building for lighting is in reality installing but a means to an end—an installation that will afford results in illumination. Competition in securing the contract leads him to figure how few outlets he can put in, how little wire and work he must use, until spacing and placing the light sources for best results in illumination are sacrificed. No merchant could build up a profitable, permanent business along these lines, nor could the central station or contractor, if the public were educated to the full value of properly treated light sources.

A general awakening of the public to illuminating engineering will eventually accomplish a closer co-operation between the central stations, light commissions, and the contractor in catering to the public's demand for a better result in the use of current for illuminating purposes. In this connection a much closer co-operation of manufacturers of lamps with the makers of light-influencing devices is to be hoped for. A standardization of lamps to meet reflector demands in carefully studied and arranged installations is imperative for continued results. The changing of one make or type of lamp to another may distort a most unsatisfactory lighting scheme into one of extreme dissatisfaction owing to the change of lamp position, due to a lack of standardization. The changing of the placement of

the filament in a reflector can easily alter the distribution from a wide or extensive one to a spot, or focusing type.

Care should therefore be used, until a standardization occurs, when relamping, to use the lamps as originally recommended, or to study carefully the lamp requirements of the reflectors to see that the filament is in relatively the same position—this in many instances may require a change in the holders from "O" to "H" or "H" to "O" position.

Illuminating engineers in the United States do not encounter this condition to the extent they do in Canada, owing to the presence here of a larger percent of foreign made lamps. It would greatly promote the intelligent use of such lamps if the channels through which they are being marketed could also furnish data as to the proper types of globes, reflectors, and holders, made by various manufacturers, best suited for their respective lamps of all sizes.

The last few years have seen a wonderful advancement in the standard of illumination—new types of high efficiency light sources and scientifically calculated globes and reflectors have largely influenced this. Commercial lighting has received the most attention with marked results, home lighting has also seen much improvement, also public buildings, offices, churches, and public highways. The field for advancement is still beyond comprehension—one of the biggest fields being in the industrial world—in the factory and shop. Complex situations existing in factories requires most careful study, and it is here that a most thorough knowledge of lamp performance and resourcefulness in engineering illumination is exacted.

In a recent factory, visited by the writer, comment was made by the manager that they had studied their lighting very carefully and he took pride in showing the same. The factory required some nine or ten different schemes of localized lighting to meet the demands of as many different machines. They were using a small semi-concentrating cone shaped tin reflector which was suited to but two machines—eighty per cent. of their machines were not properly illuminated on their working plane.

No successful clothier can do business with but one size suit in stock, or a shoe dealer with but one size shoe. No more can a factory be lighted with one type of reflector unless but one type of machine is used, which is an unusual condition, or where general illumination meets all requirements. It is essential too that reflectors that afford the maximum illumination on the required plane be selected. The proper sized lamp and its placement are also much more important than most factory superintendents realize. Over illumination is as bad as under illumination in many cases. This is particularly true where polished surfaces are being worked upon.

You have here but a few facts and conditions that promote results in illumination. There are many others,—color schemes, architectural limitations, care and consideration of equipment—these all have their influence on results which must be a big factor in figuring that one big asset of the central station, "a satisfied customer."

A Description of the Relative Merits of Clay and Fibre in Underground Electric Distribution

By William D. Ligon

The history and development of underground systems of distribution, while extending over a comparatively short period of time, is filled with interesting changes, not only in methods of construction, but also in materials entering into the work. No attempt, however, will be made here to cover the many points involved, and the object of this paper is to present a comparison between the two more

important types of conduit on the market to-day, namely, tile and fibre conduit, respectively.

Multiple and single duct tile.—This style of duct has been in use for about 25 years and is manufactured from vitrified clay in a single duct, and multiples of two, three, four and six ducts in either round or square bore. The ducts are laid end to end, with dowel pins to hold in alignment, and usually surrounded with an envelope of concrete about three inches in thickness, as a protection and reinforcement to the entire structure. Joints are staggered and wrapped with either burlap or iron and cemented with mortar.

This material, if properly vitrified and glazed, will last indefinitely. When free from iron it possesses high insulating properties, and costs less per duct foot, f.o.b. factory than any other conduit on the market to-day. It also possesses great mechanical strength and shows an average puncture test of 25,000 volts dry and 21,000 volts after immersion in water for 150 hours.

While the dielectric strength of tile is very high, the insulation of a system is greatly lowered, in consequence of the large number of joints to be closed with cement or other moisture absorbing material, and instead of the entire system testing out at 21,000 volts, it is found, when taking the joints into consideration, that an installation will rarely show a dielectric strength greater than 5,000 volts, depending, however, on the general characteristics of the earth surrounding the ducts. In making the joints in multiple duct tile, it is impossible to prevent communication between the ducts, and due to this condition multiple duct affords the lowest protection to the cables and the action of electrolysis is more liable to occur than in single duct installations.

The weight of 3½-inch tile is approximately eight pounds per duct foot and the heavy weight, therefore, increases the cost of freight, handling, carrying and laying and in propositions involving the use of tile the question of breakage is also an important item of consideration and may often amount to as much as one-tenth of the total shipment.

Due to off-sets, seams and roughness at the joints, extreme care must be exercised in pulling through the cables to prevent abrasion to the sheath, and if cables are not installed properly, short circuits and cable troubles will be encountered, resulting in shutdowns and expensive repairs, which increase the operating expenses to an excessive degree in the course of a year. Few manufacturers of vitrified clay recommend the use of tile bends in subway distribution, due to the roughness of the interior, and it therefore becomes necessary to replace with manholes or hand holes, which increases the cost of the entire system. It has been demonstrated by experience that the cost of subway installation where tile is used for conveying the cables is considerably higher than the same installation with the newer type of material, due to the necessity of employing a higher class of labor, and the large percentage of duct which is furnished without true ends, and with seams, off-sets, blow-holes and improper glaze.

Fibre Conduit.—Fibre conduit has been in use about 8 years and is formed in cylindrical shape from fibre or wood pulp under pressure. The wood pulp is thoroughly saturated with a bituminous compound and any vegetable matter or bacteria which would tend to promote decay is killed by the presence of about six per cent. of creosote salts in solution. There are at the present time two types in general use, known as "straight" joint and "bell and spigot" joint conduit, made in four styles of joint to meet the general conditions of service, namely socket (mortise and tenon) joint, sleeve joint, drive joint and screw joint, furnished in either 1-inch, 1½-inch, 2-inch, 2½-inch, 3-inch, 3½-inch and 4-inch sizes. It has been shown that fibre conduit will

stand an average puncture test of 32,000 volts dry and 24,000 volts after immersion in water for twenty hours.

As to the life of the fibre it can only be said that samples recently excavated from the first installations show no deterioration, either mechanically or electrically. It is a well-known fact that objects have been disinterred and found to be wrapped in cloth saturated in asphalt, evidently having been buried for hundreds of years, the asphalt in the cloth showing no deterioration. Coal tar, pitch and alleged wool felt, which is usually a combination of old rags, wood pulp, straw refuse, cotton and jute, was taken out of the subway, built by the New York Central & Hudson River R. R. approximately 35 to 40 years ago, and found to be in perfect condition. Bituminous substances preserve materials indefinitely when oxygen and the actinic rays of the sun are excluded, as is the case when a piece of conduit is buried in the ground. Furthermore, the creosote salts positively fumigate the material and stop mould and rot. There are roofs of buildings made of bituminous compounds that have been continuously subjected to oxygen and actinic rays similar to those used for impregnating fibre conduit and have given good service for more than thirty years. It is also a well-known fact that railroad ties, treated with an oil in which creosote occurs in sufficient quantity, are immune to rot and decay. Their life has not been determined, inasmuch as ties are now in service that were treated with carbolineum more than twenty-five years ago, and carbolineum is nothing more than creosote oil.

It has been calculated that about ninety per cent. of all cable troubles are directly traceable to some injury to the lead casing when being drawn into the duct. Cable troubles are also due to current leakage through the joints. These objections are largely eliminated by the use of fibre conduit, due to the smooth interior and watertight joints. Unlike joining tile conduit, the connection made with fibre conduit is ideal, affording perfect alignment without the use of mandrels or dowel pins, and not having to use cement, mortar or burlap at the joints.

Fibre conduit is also practically impervious to moisture, gases, acids or other corrosive elements. It is a good non-conductor, doing away with the trouble with stray currents, and is also a protection against electrolysis, which destroys many cables, and gas and water pipes. It is calculated that a pressure of 5 volts will destroy a water pipe or cable in about nine years, and there are few railways or light and power companies who have not been troubled with electrolysis. On account of the lightness in weight, large savings can be effected in freight, trucking, excavating, handling, laying and the amount of concrete necessary. In shipping and handling fibre conduit, breakage is practically nil, due to the great tensile strength of the wall and the shock-resisting properties of the material.

General.—In considering, therefore, the merits of the two more important materials for underground systems of distribution, it must be understood that each has its important field, and the conditions which govern these installations are to be considered carefully from the standpoint of interest and depreciation on the investment and the best service that can be obtained without interruption.

The question of mechanical strength of fibre or tile when laid in concrete is of little importance, as the best concrete to-day will stand a compression test of about 3,000 lbs. to the square inch, which is ample to meet the most exacting conditions of service.

News has been received in Montreal of the death of Mr. E. W. Humphrey, who was some years ago prominent in that city as the president of the Northern Commercial Telegraph Company. He died in Brooklyn, N. Y.

Personal Mention

Mr. T. R. Price has joined the sales staff of the Packard Electric Company with headquarters at Toronto.

Mr. L. W. Morden has been appointed sales engineer of the Packard Electric Company with headquarters at Toronto.

Mr. A. S. Herbert, Canadian manager Siemens Bros.' Dynamo Works, has just left for a short trip to England in connection with business of the Siemens companies.

Mr. C. H. Abbott, Western Manager of the Packard Electric Company at Winnipeg, spent a week at St. Catharines attending the conference of the Selling and Factory staffs.

Mr. William Rae, provincial inspector of tramways in British Columbia, has now received the additional appointment of Dominion inspector of tramways in the same province.

Mr. Severn D. Sprong has resigned his position as chief electrical engineer of J. G. White & Company, and accepted that of electrical engineer of the Brooklyn Edison Company, retaining the relation of consulting electrical engineer to J. G. White & Company.

Mr. Harry B. Logan, President of Dossert & Company, sailed from New York on the S. S. Almirante on January 17th on a trip to the West Indies and Central America, taking in the Panama Canal. Mr. Logan reports a healthy increase in the exports of Dossert specialties.

Mr. C. P. Lindsley, President of the Lindsley Brothers Company, Spokane, Washington, manufacturers of cedar poles, ties and cross arms, left Spokane January 5, for an extended business trip to eastern cities. He will visit Chicago, Pittsburgh, Philadelphia, New York, Buffalo, and Toronto.

Mr. C. E. A. Carr, for the last two years general manager of the Quebec Railway, Light, Heat and Power Co., has resigned that position to become general manager of the New Orleans, Southern and Grande Isle Railway, with headquarters at New Orleans. Mr. Carr's work in Quebec has consisted in the co-ordination, into one large workable unit, of a number of smaller systems including electric generating plants, distribution plants, electric and steam railways and gas plants. The work he is undertaking in New Orleans is of a similar character but on a considerably larger scale.

Mr. A. G. Chisnall of the engineering staff of the Shawinigan Water & Power Company, Montreal, has recently severed his connection with that company and joined the staff of Irving Smith, electrical apparatus and specialties 406-7 St. Nicholas Building, Montreal. Mr. Chisnall has had a wide experience with electrical companies in England, the United States and Canada, having been with Crompton & Company, The British Westinghouse Company, Siemens Bros. Dynamo Works, Dick Kerr & Co., Western Electric Company of Chicago, the Westinghouse Electric Manufacturing Company, and the Allis-Chalmers-Bullock Limited, Montreal. Mr. Chisnall will look, more particularly, after the machinery end of the business.

Automatic Reversible Battery Boosters

This article is continued from the January number. The first part dealt with the regulation of direct-current equipment by automatic battery boosters. The second part of the article discusses regulation on alternating current systems.

A booster employed in conjunction with an external automatic regulator has an advantage over the diverter booster in that much quicker reversal of voltage can be effected, due to the fact that the regulator can be so designed that a multiple exciting effect is obtained, the automatic action of the regulator checking the effect before over-regulation takes place. Another advantage is that with a good external automatic regulator the benefits of accumulator storage can be readily obtained on alternating-current systems, the main solenoids of Entz and Tirrill regulators, for example, being easily adapted so as to be suitable for alternating-current working. Very little has been done in this direction in this country, due, perhaps, to a large extent to our proverbial conservativeness, but very large installations have been put down in America operating on this principle. Various papers have been read before the American Institute of Electrical Engineers describing both complete installations and pieces of auxiliary plant for controlling the batteries. The most prominent name in this connection is that of Woodbridge, who has invented many exceedingly interesting pieces of apparatus, most of which are in use at the present time, and some of which will now be described.

The use of diverter boosters, as described in the earlier part of the paper, is confined to direct-current systems and regulation of alternating loads must be effected by plant controlled by an external regulator, although a special exciter described hereafter is worked on a somewhat analogous principle to that of the direct-current diverter booster. Regulation may be required on purely alternating-current systems, or on systems on which both alternating and direct current are employed; different arrangements have naturally

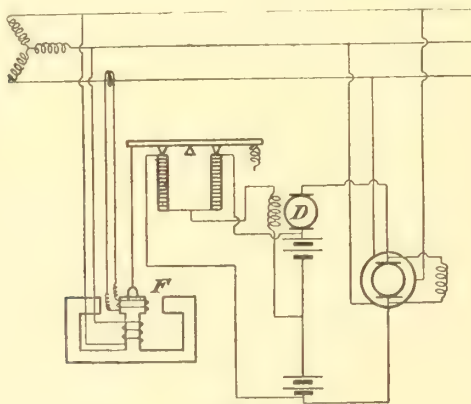


Fig. 5

to be made to suit the different cases. Arrangements have to be provided for transmitting power both from the alternating-current side of the system to the battery, or direct-current side, and for transmission in the opposite direction. The external regulator or exciter is used for controlling the transmitting link between alternating-current and direct-current sides of the system.

Alternating-current Solenoid.—As in the case of the direct-current booster, perhaps the simplest arrangement is the employment of an Entz regulator operated by an alternating-current solenoid, responsive to variations in the energy component of the alternating current, the regulator

controlling the alternating-current, direct-current transmitting plant. Such a solenoid is shown at F in Fig 5.

It consists of an iron magnetic circuit magnetised from the line potential difference on the alternating-current circuit, the magnetising coil being shown wound round the middle yoke. On the enlarged end of this middle yoke there is placed a movable coil, which is suspended from one end of the lever of an Entz carbon regulator; the coil is connected across the secondary of a current transformer, the primary of which is in series with the main which has no voltage connection. The flux in the core splits and crosses two air-gaps to re-enter the centre core, and, being produced by the potential coil, connected as shown, will lag 90 degrees in phase behind the line voltage. At unity power factor in the main alternating-current circuit the current in the movable coil will lag 90 degrees in phase behind the voltage across the potential coil, and hence the current in the movable solenoid and the flux in the air-gaps will be in phase with each other, and a pull will be exerted by the solenoid on the lever of the regulator, the pull being proportional to the product of the flux in the air-gaps and the current in the

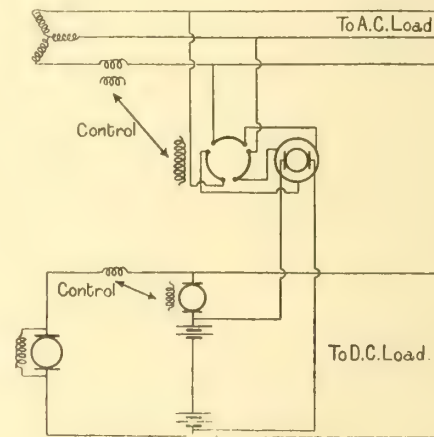


Fig. 6

solenoid. If the power factor is not unity the pull of the solenoid will be proportional to the product of the magnetic flux in the air-gaps and the energy component of the current, this component being, of course, in phase with the flux. The wattless component of the main a.c. current will have no effect on the lever of the regulator. The effect of the pull on the lever will be to operate the Entz regulator in the usual manner. An increase in alternating-current energy above the desired mean will cause the booster D to discharge the battery into the rotary circuit. If the energy in the main alternating-current circuit falls below the desired mean (this mean being obtained by adjustment of the regulator spring, as usual) the booster voltage will be in the charge direction, and energy will be transmitted from the main alternating-current circuit via the rotary converter into the battery. Other types of external regulator may be used in a manner similar to that just described.

Motor-generators and Converters.—Either the motor-generator or the converter type of plant may be used for the transference of power, but the latter is more suitable where quick regulation is required, as the single converter machine will respond to the control somewhat more quickly than will the combination forming the motor-generator. The boosting effect necessary to cause a transference of energy between the battery and the load circuit may be obtained by the provision of a direct-current booster on the battery

side of the transmitting plant, as indicated in Fig. 5, or an alternating-current booster on the load side, as in Fig. 6, which shows both an alternating-current and a direct-current load being regulated, the fields of the boosters being made responsive to small variations in the load on the alternating-current and direct-current generating plant respectively. Details of the method of control are omitted for clearness. The use of a booster as indicated should prove very convenient in cases where the booster may be fixed on an existing converter.

Split-pole Converter.—In order that the auxiliary booster plant might be dispensed with the split-pole rotary converter was developed. This machine and its theory are explained in a paper by Mr. J. L. Woodbridge (Transactions

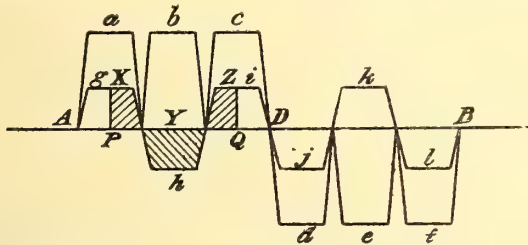


Fig. 7.

of the American Institute of Electrical Engineers, vol. 27, p. 987, 1908). In the ordinary converter there is, of course, a fixed ratio between alternating-current and direct-current voltages, and the object of the split-pole machine is to allow of a variable ratio by causing the direct-current voltage to vary in response to load variations in the generating plant, while the alternating-current voltage is maintained constant, or approximately so.

Fig. 7 is a copy of a figure in Mr. Woodbridge's paper, and serves to show, in an elementary fashion, how the variable voltage ratio is obtained. In the case illustrated the poles are divided into three parts, and the flux distribution is shown roughly at a, b, c, d, e, f, under a pair of poles, the flux from each pole being assumed to cover exactly a pole-pitch. Should the excitation be altered so that the two outer parts of each pole are strengthened and the middle part weakened, the result is equivalent to the effect of such a field as that shown at g, h, i, j, k, l, super-imposed on the main field. The flux represented by the shaded area Y at h is exactly cancelled by an area X, and an area Z, shown at g and i. The result is that the potential of the points P and Q remains unaffected, but the potential of points A and D increases, due to the overall increase in flux between the two points. It will be seen that the points P and Q are 120° apart and correspond to 3-phase tapplings, and points A to D are 180° apart and correspond to direct current-brushes.

The effect is therefore an increase in direct current voltage without alteration of the alternating-current voltage. An exactly opposite effect on the direct-current voltage would be obtained from a strengthening of the middle part of the pole and a weakening of the outer parts.

In practice there is a neutral zone at the points where the direct-current brushes are placed, but it is found that this, although altering the wave shape of the voltage curve, does not appreciably affect the working of the machine.

The raising and lowering of the direct-current voltage can be utilized to cause a battery connected across the direct-current terminals of the rotary to charge and discharge, alteration of the converter field being made responsive to small variations in the generator load by means of an automatic regulator.

The split-pole converter has also been used as a two-pole machine with success, and it is found that with

a 20 per cent. variation of direct-current voltage above and below the mean—i.e., 20 per cent. on each side—the variation in alternating-current voltage is about 1 per cent. on each side of the mean value.

Automatic Exciter for Alternative-current Working.

Mr. Woodbridge, in the paper already referred to, describes a new form of automatic exciter suitable for controlling equalizing plant on alternating-current systems. The principle of this is shown in Fig. 8. The figure shows a 2-pole armature revolving in a 4-pole field, the two upper poles being wound so as to have one polarity, and the two lower ones the opposite. The armature windings are connected to the secondaries of current transformers in the main generator circuit, as indicated in the diagram. A revolving field is accordingly set up due to the alternating current in the armature. This field is rendered stationary in space by the armature being revolved synchronously in an opposite direction by means of a synchronous motor directly coupled to it.

The field winding is connected across a constant potential direct-current supply, and the current in it can be so adjusted as to just balance the field set up by a desired value of alternating current.

There are two pairs of brushes on the commutator, one pair being fixed so that the diameter joining them is in the direction of the field set up by the alternating current, and the other pair displaced at 90° from the first pair. This second pair are short-circuited, and the first pair are connected to the controlling field of the equalizing plant.

When the field produced by the alternating current is just neutralized by the magnet winding there is no potential difference between the points C and D, but, should the two opposing fields not balance each other, there will be a re-

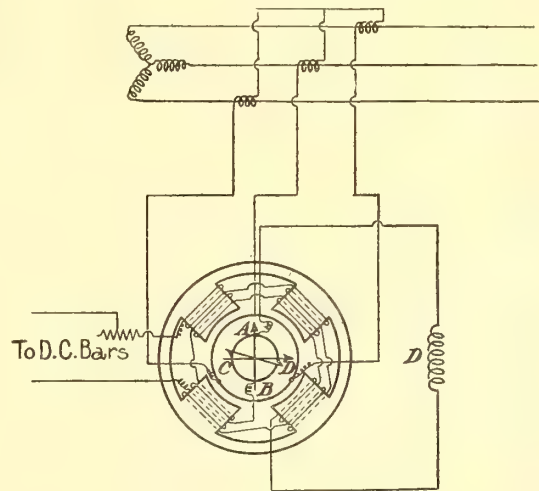


Fig. 8.

sultant flux in the direction of the vertical centre line, and hence there will be a voltage between the short-circuited brushes. A current will therefore flow between those brushes, setting up a flux in the direction of the diameter joining them. This flux will cause an e.m.f. to be generated between the other pair of brushes A, B, which are connected to the exciter field shown at D, the booster or other equalizing machine being, as a consequence, excited in such a way as to prevent further variation of the main generator load than the small amount necessary to upset the balance of magnetomotive forces and give the effect just described. The second winding shown on the magnets is designed to compensate for armature reaction in the exciter due to the current flowing to excite the controlling field D.

Advantages of Automatic Exciter.—The following are

the important features claimed in connection with this exciter.

1. It acts as a multiplying device, a magnifying effect being obtained in the short-circuit current flowing between brushes C and D. This makes it sensitive to small changes in alternating-current load.
2. By the provision of a suitable angular relation between the exciter armature and the armature of the synchronous motor which drives it, the exciter can be made to respond to any desired phase component of the alternating current to be controlled.
3. It may be used to control the power factor of the main circuit if the connections to the pairs of brushes are interchanged, the exciter field winding being replaced by a field coil on some synchronous machine connected to the supply. Two exciters such as that de-

scribed can be used, one being employed to regulate the load on the main generating plant, and the other to regulate the power factor of the circuit in the manner just indicated.

Another advantage claimed for this type of exciter is that the automatic regulation of load can be stopped immediately by the short-circuiting of the current transformers, armature reaction preventing excessive currents even with considerable direct-current excitation. This is of considerable advantage as, once the apparatus has been used for a short time, the regulating rheostat in the separately excited shunt field circuit can be calibrated in terms of the alternating-current generator current, so that when it is desired to put the battery into service as a regulator of the load it is only necessary to set this rheostat to a position corresponding to the load desired on the generating plant, and open the switch short-circuiting the secondaries of the current transformers. The generator current will immediately assume the value imposed on it by the value of the exciter shunt winding.

The Simcoe Railway and Power Company

Description Continued from January Issue—Substantial Power Building, Samson Turbines, Westinghouse Generators and Transformers—Well Planned Throughout

The generating station at the Big Chute, as described in an article in the January number, is arranged for five power units; three of these are now installed along with two exciters, while the foundations are already placed for the two future units.

The power house is built on a ledge of rock extending into the lower pool and sufficient excavation was made into the cliff behind to allow the foundations to lie completely on the ledge. The piers and foundations are of massive concrete extending about 23 feet from bed rock to floor level. All piers and walls are tied into one another above the water line, and again at the floor line, by reinforced struts and beams making an essentially homogeneous structure. The tail race extends longitudinally under the floor line and has large openings to the tail water between the generator piers and through arched openings in the outer wall.

The walls are of concrete slabs between heavy pilasters, the pilasters carrying the crane rail and roof trusses. The rear portion of the station has the floor eleven feet higher than the generating room floor leaving space for the penstock and feeders underneath; this floor contains the low tension switchboard and its equipment and the transformers while a second floor above the

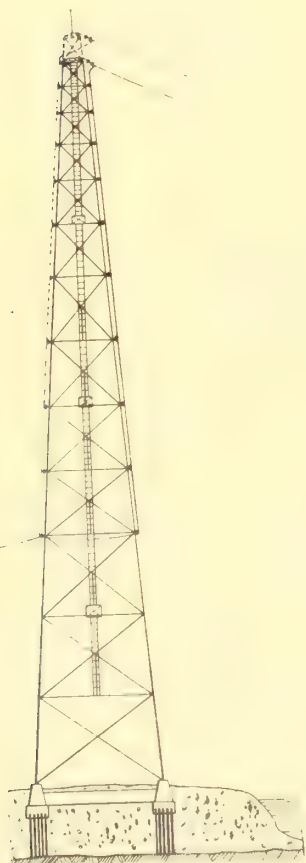
switching room contains the high tension switching and line equipment. The rear portion of the building has a heavy concrete roof carried on reinforced beams while the roof of the generating room is of 1¼ inch matched pine carried on heavy wooden purlins which are hung by wrought iron hangers from the steel roof trusses. Both roofs are covered with several layers of asbestos felt laid in asphalt cement; the Johns-Manville Company were the contractors for this portion of the work. The general works and the power station were constructed by Messrs. Pratt & MacDougall of Midland.

The turbines were built by the William Hamilton Company of Peterborough, Ontario, and are of the "Samson" type. The power turbines are designed for 1300 horse power capacity under 56 feet head and a speed of 300 revolutions per minute. The double runners, of the Francis type, are of bronze, 35 inches in diameter, and the water discharges into a single steel draft tube inclined towards the front of the power house. The turbine case is carried on a series of heavy "I" beams spanning the tail race.

A 66-inch vertical gate valve is set in the horizontal feed pipe between each turbine and the penstock; the valve is erect in Nos. 1 and 2 units while in No. 3 the stem is downwards and is protected by a concrete housing. All 66-inch valves are being arranged for alternating current motor operation while the auxiliary hand mechanism will allow for complete opening or closing in about two hours by one man. The valves have strongly ribbed cast iron bodies with bronze mountings on all bearing and rubbing faces. Each valve is tested to a working pressure of 50 lbs. per square inch and operation under 75 feet head. A six inch by-pass with valve is provided with each.

The exciter turbines are of the single runner type, 17 inches diameter, and are capable of producing 200 horse power under 56 feet head at 580 revolutions per minute. The valves on exciter feeders are 30 inches in diameter.

The hydraulic turbine governors are all of Lombard oil pressure design, types N and Q 7½ being installed for power turbines and type P for exciters. The governors in combination with the surge tank on the penstock, and the heavy fly-wheel effect of the generators, have given



175 Ft. Transmission Tower.

excellent results on test while with the surge tank acting and full load thrown off the turbines the pressure rise in the turbine cases is hardly appreciable.

The power generators are of Canadian Westinghouse Company's manufacture, as is practically the whole of the electrical equipment. These generators are of 900 kv.a capacity, 2200 volts, 60 cycles, three phase at 300 revolutions per minute. The armatures are wound in three slots per pole per phase, the slots being open; the field is revolving and the rotor will withstand the stresses of a runaway speed 75 per cent. in excess of normal.

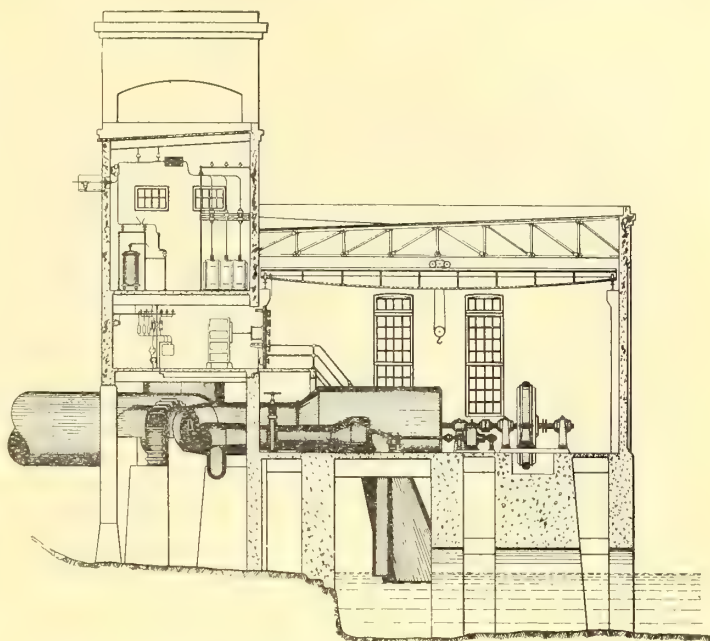
The exciters are of 100 kilowatts capacity at 125 volts and are controlled by means of a Tirrill regulator to automatically produce a varying strength of field on the power generators to maintain a constant voltage at the end of the 25-mile transmission line. The two exciters are direct connected to their turbines. The turbines are arranged to take water from either penstock, when the second penstock is installed or for each to be fed from a separate penstock thus providing for continuity of exciter current.

The current from all generators on the main floor is carried through cables, laid in fibre conduits, to the switchboard on the gallery and from thence to the transformers and ultimately through the high tension switching room to the line.

The transformers are three single phase units aggregating 1800 kilowatts capacity. These are connected in delta so that in case of accident to one unit the two others may be used for continuing the service. The voltage ratio is 2200 to 25000, the latter being the transmission voltage. Water for transformer cooling purposes is supplied through the station water piping from the stand pipe; a cleaning strainer is attached to the source.

The electrical circuits are arranged so that each generator may be switched on either of two sets of 2200 volt bus-bars. Each of these bus-bars feeds into one 1800 kw.

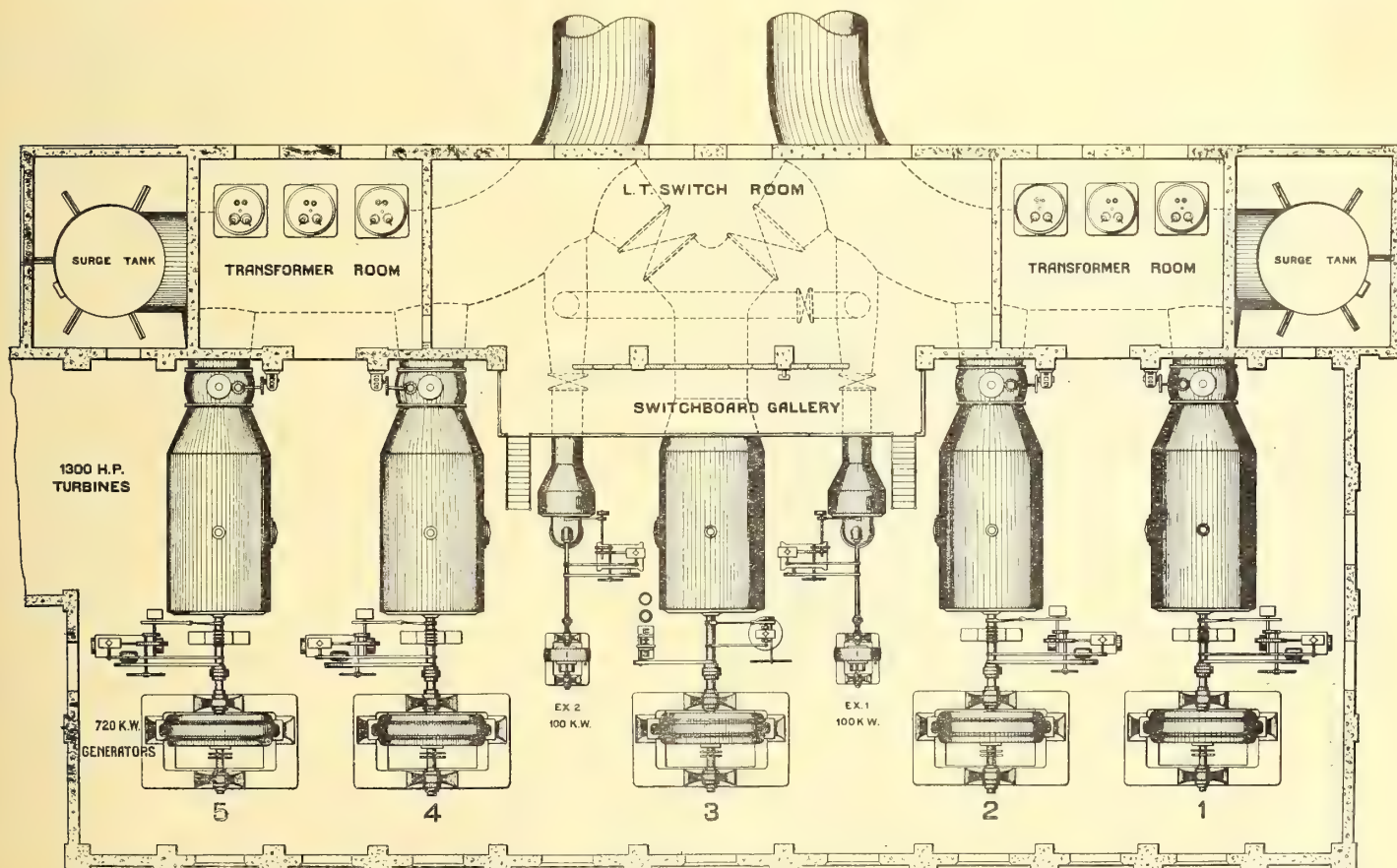
transformer bank through a circuit breaker and the two transformer sets may then be connected in parallel by a tie oil switch. Each transformer set on the high tension side



Section Generating Station, Big Chute, Severn River.

feeds to a 25000 volt bus-bar to which the transmission line is connected through the line circuit breaker. When the second transmission line is constructed the high tension bus may be divided so that each of the two transformer sets may feed their corresponding lines independently.

The switchboard consists of twelve black marine finish marble panels which are arranged in three groups, spaced by the concrete columns which extend from the switch-



Plan of Generating Station Simcoe Railway and Power Company, Big Chute, Severn River.

board gallery floor, so that the five generator panels and the bus tie switch panel are between the columns while on the left is the direct current board of three panels, including the Tirrill regulator and on the right are the two transformer panels (one blank at present) and the line panel.

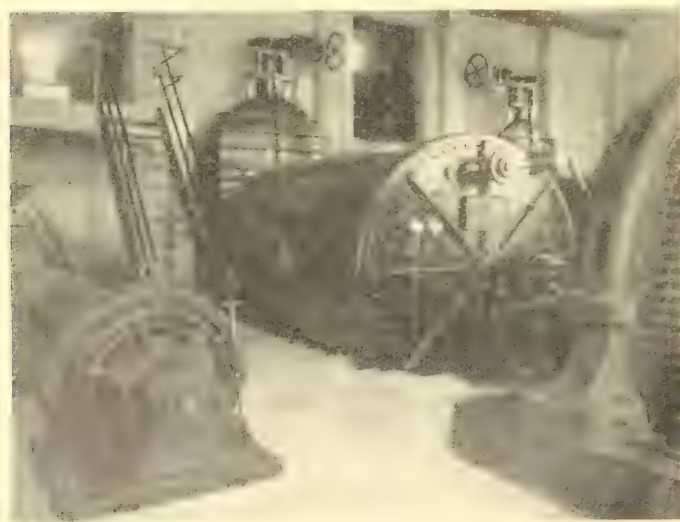


High Tension Room, Generating Station.

The gallery extends six feet into the generator room while behind is ample room for the 2200 volt bus and switch structure and the generator rheostats. The rheostats are carried on concrete pedestals to allow for ventilation, and are operated by shafts in a straight line between rheostat handle on the switchboard and the face plate on the rheostats.

In the transformer room disconnecting switches are arranged inside the low and high tension delta connections so that any single phase transformer can be temporarily cut out. The leads on the high tension side are carried through a wall opening into the line room where the three 25000 volt oil switches, the electrolytic lightning arresters and the choke coils are located as shown in one of the accompanying photographs.

The transmission line outlets are at the rear of the



No. 2 Generating Unit and Exciter.

power house and consist of porcelain outlet insulators in a 14-inch opening in the concrete wall. The outlet is protected outside by a hood of a one-half section of a 42-inch corrugated iron culvert carried on steel angle brackets inserted in the wall; this has proven a very cheap and effective outlet covering.

The transmission line is approximately 25 miles long, the route being south-west to Waubaushene on Georgian Bay and thence to Midland, generally following the roadways along the Georgian Bay shore line. Half of the distance, from the Big Chute to Waubaushene, is over the company's right-of-way which has been cleared and laid out for two parallel transmission lines.

The poles are generally 35 feet in length graded to conform to the profile of the route. The conductors are No. 00 B & S aluminum cable supplied by the Northern Aluminum Company and are carried on 35000 volt porcelain insulators spaced in an equilateral triangle, forty-two inches apart with the apex at the top of the pole. A photograph shown herewith indicates a typical portion of the line.



Typical Section of Transmission Line.

Special pole arrangements were made for railway and telephone crossings.

A telephone line extends from Big Chute to Midland, carried on the pole line. Heavily insulated transformers are placed at each terminal with the local services on the secondaries so that no accidental high voltage on the secondaries can be dangerous to the telephone operators.

At Waubaushene, the Matchedash Bay arm of Georgian Bay is about 2000 feet across and two spans are made 1153 feet and 858 feet respectively. The longer span also crosses the ship channel which is close to the west shore and the Government requires 150 feet clear at this point between wires and water, necessitating a 175-foot tower; the centre and east shore towers are 88 feet high giving a forty foot clearance on the 858 foot span. The long span is made with copper cable of 7 No. 9 B&S strands while the 858 foot span is made with 300,000 c.m. aluminum cable, the copper and aluminum being spliced together at the centre tower with a special aluminum clamping device while the other ends are clamped to a 2 unit suspension insulator. The cross arm decks of the shore towers are fitted with iron sheaves and turnbuckles so that tension may be put on the steel cable supporting the insulators to allow for adjustment of the sag should occasion demand. The connecting cables are attached to the span cables at the suspension insulators and are carried down the sides of the towers on insulators to within 50 feet of the ground and from thence to the pole line. The towers are arranged with gusset plates at the top to accommodate an additional deck so that a second line may be eventually carried above the first.

An accompanying drawing shows the general construction of the 175 foot tower which is 30 feet square on the base. The rock surface is 17 feet below the surface and 80 piles, twenty to each pier, were driven to broom on the

rock. The heads of the piles were interlaced with $\frac{3}{4}$ inch steel to cable and capped by a block of concrete into which were bedded $1\frac{3}{4}$ inch steel cables extending between each of the four piers and also embedded into a heavy concrete strut so that the whole sub-structure consists of a massive single foundation. At each corner a concrete pier extends five feet above the concrete cap and in each pier two 1 inch and two $1\frac{3}{4}$ inch bolts extend down into the cap as anchor bolts for the tower legs.

At Midland the company has acquired a plot on the outskirts for the sub-station and construction yard. The sub-station is of brick arranged for extension as the market may demand. The present equipment has transformers, line apparatus and a switchboard similar to those of the

generating station. Distribution is at 2300 volts to Midland and the surrounding district. The Hydro-Electric Commission undertakes the distribution in Midland and Penetanguishene.

The Simcoe Railway & Power Company is formed of well known business men connected with the various large concerns in Midland, the officers being, W. J. Lovering, Toronto, President; W. Finlayson, Midland, Secretary; and D. L. White, Midland, Treasurer.

The engineering of the development was carried on by Messrs. C. H. and P. H. Mitchell from its inception. The resident engineers were Murray C. Hendry, B.A.Sc., during construction and O. L. Flanagan, B.A.Sc., during installation.

Insulators—Their Manufacture and Tests

By G. Parker, B. A. Sc.

Recent developments in the transmission of electrical energy over long distances at potentials which until the last year or so were considered prohibitive have produced a demand for insulators, for both line and station work, that will withstand with a high degree of reliability the enormous potentials now used.

For many years previous to the development, on a commercial scale, of porcelain as an insulating medium, glass was universally used. It satisfied the requirements of the time, affording high dielectric strength, and could be manufactured at a comparatively low cost. The chief objection to its use lay in the fact that it is very unreliable when subjected to mechanical shock and thus could not be depended upon for supporting large spans of heavy conductors. Further, unless it is annealed very carefully, internal strains are set up which render it still more liable to failure in service. Also, higher operating voltages demanded insulators of greater size and glass was found unsuitable for such work. Manufacturing problems, too, were encountered which made the use of glass impossible.

Porcelain was found to be superior to glass for high tension requirements and is entirely used for this work at present. While of lower dielectric strength than glass it is much more uniform in grade and much more reliable mechanically. There has been little difficulty experienced in manufacturing porcelain parts of intricate shapes suitable for special work such as entrance insulators, strain insulators, and busbar supports.

The qualities required in an insulating material are—dielectric strength, mechanical strength, ease and flexibility in manufacture and capability of withstanding severe weather conditions without chemical or physical deterioration.

Dielectric strength is the first essential quality, as upon it depends the value of the material as an insulating medium. When subjected to dielectric strain the tendency to rupture is as real as if the material were under a mechanical strain. When the dielectric strength of any given material is exceeded, puncture occurs directly through the material and in the case of glass or porcelain may completely shatter it.

Mechanical strength is necessary in order to support the weight of the conductor. This is especially true when steel towers are used as line supports, as these permit of the use of much longer spans than with pole line construction. This increased spacing results in a greater length and hence a greater weight of conductor being supported by the insulators at the ends of the span. In addition to the strength necessary to meet normal working conditions the insulator must be designed further to meet severe shocks

successfully. The strain experienced by an insulator on the line during a "spill over" or direct stroke of lightning is of the nature of a severe mechanical shock coincident with high dielectric strain.

The material from which an insulator is made must, after firing be absolutely impervious to moisture, deterioration and disintegration. Glass, generally considered chemically inactive, is appreciably affected by the continued action of water, and glass insulators, after years of service, have shown very distinctly the solubility of glass by a roughening of the surface exposed to the action of the weather. This roughening, it is evident, must affect both the dielectric and mechanical properties of the insulator. With insulators for use with high potentials the necessity of having a stable material is paramount. In addition to the above considerations we there have the phenomena of corona and brush discharges which are accompanied by the formation of ozone and small quantities of nitric acid in the neighborhood of the conductor. To withstand the action of these further enemies of the transmission line it is evident that the glaze and body of the insulator must be chemically inactive.

Pin or Suspension Types

The numerous points affecting the design of insulators will not be discussed here. The "pin" type is in use for voltages up to about 60,000, and is found to give satisfaction. For higher potentials it does not appear that this type is suitable owing largely to the overstraining of the portion near the pin. Within recent years the suspension insulator has come into universal favor for potentials greater than 60,000 volts, and, in a few cases, has been used at that pressure. The chief factor limiting the use of this type on lower potentials is probably the cost of manufacture. Present indications are, however, that with improvements in the method of manufacture and consequent reduction of cost the suspension insulator will be used for lower potentials.

The pin type insulator is, in general, designed according to the line voltage for which it is to be used. The several parts are in most cases designed so as to best meet the required conditions. The suspension insulator unit, however, is considered simply as a condenser, the porcelain body forming the dielectric and the metal links the electrodes. Hence a given type of unit has a constant flash over voltage, other conditions remaining constant, and it is clear that a series of these units will have a flash over voltage as many times as great as that of a single unit as there are units in the series. This is based on the assumption

tion that when a number of such units are placed in series the potential stress is the same for each unit. This condition is very nearly obtained in the suspension insulator but is far from being the case in the pin type insulator.

One of the chief requirements kept in view in the design of the insulator is that of obtaining a high puncture strength compared to that of flash over. An insulator which, during a period of overstress allows the current to flash around it, is found unharmed as a rule, when the potential is lowered and normal conditions are re-established. If, however, an insulator should fail by puncture the line may be out of commission until the defective insulator is replaced. In many cases this necessitates the examination of the insulators individually.

Another desirable condition is that the arc should flash over clear of the insulator instead of clinging to the surface. Under these conditions the probability of damage by the tremendous heat of the arc is greatly lessened. To obtain this condition the insulator is designed so that the drop over the surfaces will be greater than the dielectric strength of the air as measured by the striking distance between two consecutive units. This surface drop is more or less of an uncertain quantity, within limits, as it depends on the amount of dirt, moisture, etc., present on the surface. The design is usually made on the supposition that the upper surface of the insulator will be wet. This, with an angular percipitation represents the worst conditions of service.

Porcelain Composition

Porcelain for use in electrical work is very similar to that used in the manufacture of domestic utensils, but has slightly higher vitrification. The chief constituents of electrical porcelain are flint, feldspar and clay. This may be either "Ball" clay or "English China" clay, or both may be used in the same body. The function of flint is to give strength under heat. The melting or fusing point of flint is very high, being in the neighborhood of that of platinum. This point is lowered, however, by the introduction of clay. The clay gives a pliable and plastic body for working and moulding. It has, however, too high a shrinkage and cracks when drying. The feldspar acts as a flux, uniting the constituents during the process of firing.

The clays are imported from England by a number of manufacturers, while others use a quantity of domestic clay with a small amount of the imported clay. Feldspar is obtained to a great extent from Ontario, and some is found in the Maritime Provinces. There are two varieties of feldspar, viz., sodium and potassium. The latter is almost universally used as it gives greater latitude in firing. Sodium feldspar has a much smaller range of firing temperature and when this is exceeded the body usually blisters and cracks.

The first process in the manufacture of porcelain is the mixing of the constituents. The clay, spar and flint are ground to powder and mixed in proper proportions in large cylindrical tanks with a great amount of water. Sufficient water is added to admit of the mixture being pumped to the "filter presses." These presses consist of numerous layers of canvass through which the mixture is forced under pressure. The clay mixture is removed from the water in the form of circular layers. It is absolutely homogenous in body and entirely free from lumps of any kind. In some factories the clay is allowed to "age" in bins for from one to three weeks before it is "pugged." In others it is put through the pugging machine immediately upon its removal from the filter press. The pug mill resembles a continuous brick or tile machine and the clay as it comes out in a continuous cylindrical piece about eight inches in diameter is cut in lengths of about two feet and distributed to the machines to be moulded. In pugging, the clay is reduced to the proper density and upon this depends to a great extent the nature of the final product. The moulds in which the body

is formed are made from patterns similar to those used for foundry work. The moulds themselves are made of plaster paris and are as light as is consistent with necessary strength.

There are two general methods used in forming the unit pieces,—"punching" and "jigging." Some pieces may be made equally well by either method and others are best adapted to one or the other. The moulds in either case are almost the same. In jigging, the mould is revolved and the "tool" lowered into it, working the clay around the inside of the mould. This tool is in the form of a profile cross-section conforming to the design of the inner surface of the part being manufactured. In punching, the mould is stationary and the tool, or "centre" is revolved. The tool is the full shape of the inner surface of the part and is lowered into the revolving mould containing the clay.

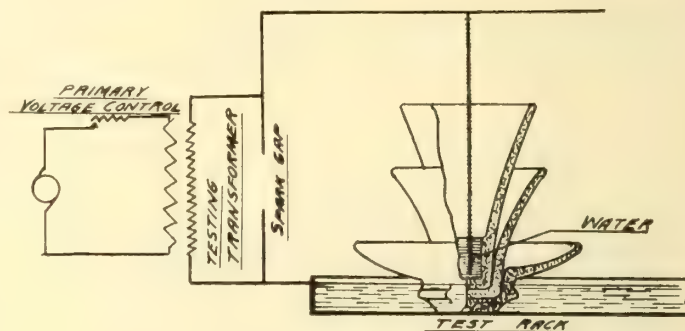


Fig. 1.—Routine test on pin-type insulator.

The rough edges are trimmed off after forming and the moulds are placed in drying racks and the clay allowed to dry until it is strong enough to be handled. During the process of drying it shrinks to a slight extent, allowing the mould to be removed easily.

The parts are then placed in a higher temperature and dried thoroughly. This may take from a few days to a week or more, depending entirely upon the size of the piece and the thickness. Trimming is next done by revolving the mill rapidly and turning down the surfaces and edges to the exact desired shape. Then the grooves for holding the cement are turned and the piece given its final finish.

The glaze is applied by dipping the piece in a mixture of the glaze and water. The composition of the glaze depends chiefly on the color desired and upon the constituents of the body. The amount of shrinkage of the body during firing must also be considered as the neglect of this would result, in most cases, in cracks and "crasing" due to uneven shrinkage. By "crasing" is meant fine hair-like cracks in the glaze only. The glaze must also have approximately the same firing temperature as the body in order that the one firing will be sufficient for both. A glaze with a lower firing temperature than the body would be over-fired when the body itself had reached the proper temperature, while one with a higher firing temperature would be under-fired by the time the body had reached the proper state of vitrification. Great care has to be exercised in dipping the parts to avoid "checking" in the glaze. The least particle of dust prevents the glaze from adhering to the body and leaves a bare spot on the finished piece. In order to avoid this the pieces are cleaned by a blast of air and dipped in the direct draft of a fan.

The most common glaze used is the brown glaze. This may be obtained by using a mixture composed chiefly of Albany clay. A slate glaze may be obtained by the presence of certain salts of the metal cobalt, the density of the glaze depending upon the amount of the cobalt compounds present. At the high temperature of the kiln the glaze combines chemically to a certain extent with the body.

Thus, it will be seen, the chemical composition of the glaze must be such as will give the desired results with the particular body with which it is to be used.

Methods of Firing

The material, after dipping, is sent directly to the kiln. In order to protect it from the direct flame of the fire it is placed in large fire-clay trays known as "saggers." These are piled in tiers in the kiln. The parts are placed in the saggers so that the unglazed portions rest upon the saggers. On no account must the glazed portion come in contact with the sagger or with another part.

Firing is done by coal or natural gas, the latter being preferable, where available. It gives a cleaner fire and some manufacturers claim it is more easily controlled. The fire is started slowly at first and gradually raised until a temperature of about 2,300 degrees is reached. This is maintained for a very short time and the fire drawn. The kiln is generally allowed to cool slowly to a temperature where the material can be handled. In some factories, however, the cooling is hastened by opening the kiln and forcing a cold draft through it. Those who do not use this latter method claim that the results are better where the cooling has been slow.

The time required to heat the kiln to the highest point is about twenty-four hours and the cooling takes about thirty-six hours. The time depends on weather conditions, the size of the kiln, etc. The temperature of the interior of the kiln is determined by means of "sagger cones" which are placed at different points in the kiln opposite small openings in the side. These cones are of material of known fusing temperature. When this temperature has been reached they become soft and collapse under their own weight. Cones of three different grades are placed in each quarter of the kiln and the temperature of the sections is indicated by these as they soften and collapse.

There are in general two extreme conditions of the material obtained by firing. If the temperature has been low the body will be soft and coarse grained and will absorb moisture. In addition it will have very low dielectric strength. If the firing temperature has been high the body will be finely grained and have a slight gloss when broken. It will be non-absorptive, have high dielectric strength, but will be very brittle. It approaches glass in its characteristics to a much greater extent than a body fired at a lower temperature. Owing to its extreme brittleness it is not reliable as a support for conductors. The quality of body striven for and obtained in practice is what might be called a compromise between the two conditions mentioned above. That is, sufficient mechanical strength to resist shock in addition to dielectric strength and good vitrification. The effect of "over" and "under" firing on the glaze depends not only on the composition of the glaze itself, but also on its chemical relation to the porcelain. Low firing gives a glaze with very little gloss.

Subjected to Severe Tests

All porcelain for high tension work is subjected to an electrical test before being packed for shipment. In the case of insulators made of several parts each part is tested before being assembled. The part is inverted in a pan of water an inch or so in depth and water is also poured into the inside of the unit, care being taken to keep the sides dry. One terminal of the testing transformer is connected to the pan, Fig. 1, the other terminal to a bare conductor placed above the pans from which a chain is hung so that it rests in the water which is in the inside of the insulator unit. This small chain is only for the purpose of giving a ready means of connecting the inside of the insulator to the transformer. Of course, many of these tests are made simultaneously. The number of parts tested at one time depends

on the size of the parts and on the floor space available for testing purposes. Where there is sufficient land procurable for the erection of buildings more space can be set apart for the test racks. This does away with considerable handling of the ware as the units after being tested are assembled on the large test racks and after having sufficient time to dry are given the final test before being removed from the racks. They are then taken directly to the packing room and placed in the crates and barrels.

The test consists in raising the potential gradually until a number of the units flash over from the water on the inside to that in the pan. This is called the "flash over voltage," and is maintained for a certain length of time after the last puncture, according to the specifications upon which the material is purchased. When an insulator fails by puncture the current passes directly through the material, leaving a minute hold and causing intense local heating. This is in most cases caused by some unevenness in the body of the material, a small amount of foreign matter or a "check" left by the moulding machine.

A properly designed and thoroughly fired part will usually withstand from three to four times the voltage for which it is designed. Assume for instance, a three part pin type insulator designed for operation at 60,000 volts. If the ideal design has been obtained, that is, absolute uniformity of dielectric strain, each part will, we will say, carry 20,000 volts without puncture. On test this part will in all probability have a flash over voltage of 70,000 or 75,000 volts. In actual practice, however, it has been found that the distribution of stress is not uniform, that is, one part of the assembled insulator may be subjected to a much greater strain than that for which it was designed, while another part will be stressed to a point much below that for which it was designed. This characteristic is one of the factors which renders the pin type insulator impracticable for use on high voltages. In the suspension type insulator the principle on which it is designed insures almost uniform distribution of stress.

The part test picks out the weaker parts and hence the more severe and thorough it is the smaller will be the per-

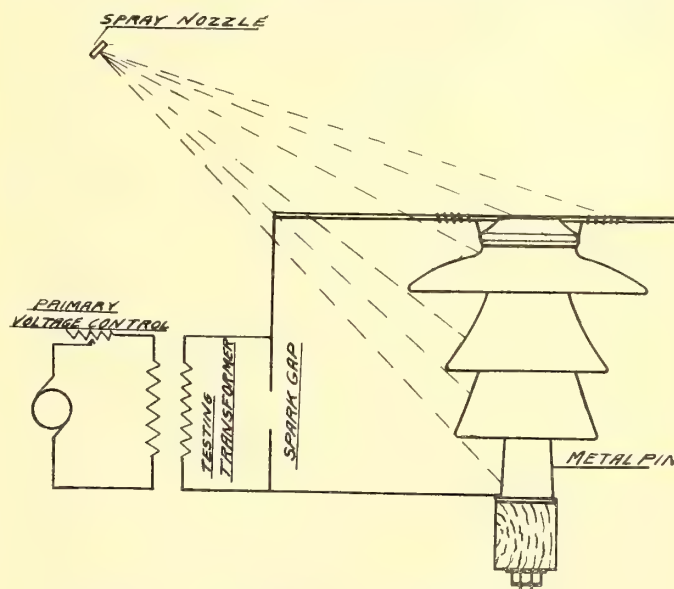


Fig. 2.—Arrangement for flash-over tests

centage of failures in the assembled test, since, in most cases, the failure of a part in the assembled test renders the whole insulator useless. The part test having been completed the parts are assembled and cemented together with "neat" Portland cement. In the same way the caps and hooks are secured to the porcelain part of the suspension insulator. Having dried sufficiently the finished insu-

lators is given a final or "assembly" test, usually at flash over voltage. If the ware is good and the part test has been thorough the percentage of failures on the assembly test should be very low, in most cases being in the neighborhood of one per cent. for a high tension pin type insulator, and even less than this for suspension insulators. In some factories the suspension units are given a mechanical tension test before shipment.

Engineering specifications, in addition to the part and assembly tests, call for "dry and wet flash over tests" and "immersion tests," Fig. 2. In the dry test, samples of the insulator are chosen at random and if of the pin type are mounted on the pin and cross arm similar to that with which they are to be used. All dust and cement is removed and the insulator cleaned thoroughly. The potential is impressed across the insulator from the pin to the wire groove and gradually raised till flash over occurs. This is held for a length of time depending, as in the part test, upon the specifications. The wet or "rain" test consists in testing the insulator when under a precipitation from either a vertical or angular direction. The usual conditions for this latter test are a precipitation of not more than 0.3 and not less than 0.2 inches of water per minute directed at an angle of 45 degrees from nozzles not closer than thirty inches from the insulator, the pressure at the nozzles to be not less than thirty pounds per square inch as measured by gauge. In general, specifications call for a dry flash over of at least three times line voltage and a wet flash over of at least twice line voltage. These conditions necessarily vary with the locality in which the insulator is to be used. In the immersion test the insulator is given a dry flash over and immersed in water for a number of days and again given a flash over test. Any absorption is accompanied by a decrease in flash over voltage.

Factory Tests Cannot Cover Live Conditions

While the endeavor has been in the past to have factory test conditions similar to those encountered on the line it is generally felt that this is far from being the case. In fact the actual conditions existing on the line when an insulator flashes over has not been fully investigated. This is not from lack of interest on the part of engineers but from difficulties encountered in making such an investigation. The frequency of the impressed potential governs, to a large extent the flash over voltage, and also the apparent dielectric strength of the material. Prof. Creighton, in a recent discussion before the A. I. E. E. pointed out that an insulator that had successfully withstood, without puncture, its flash over potential obtained from a testing transformer, failed under the discharge from a battery of Leyden jars. He attributes the difference to the fact that in the first case a corona envelope surrounded the terminals, thus reducing the effective striking distance. Hence the strain on the material would not be as great as in the case of the discharge of Leyden jars, which was instantaneous.

There are three general methods in use for obtaining a wide range of voltage, viz.—generator field adjustment, water rheostat and induction regulator. The chief objection to the first lies in the fact that the voltage wave will be subject to more or less distortion, especially when the generator is working at low excitation. The use of the water rheostat gives a fine adjustment, but tends towards the formation of static peaks on the wave. The induction regulator furnishes a better regulation, as the wave form is not altered materially throughout the working range. This method is growing in favor among the manufacturers.

The question of the fatigue of porcelain is at present occupying a prominent place in the investigations of engineers. Recent experience has led to the belief that line insulators after continual service are not as efficient as when new. A large operating company in the Western States have

had a rather unusual experience in this connection. For a number of years their insulator failures were comparatively few, causing no unusual trouble. Recently, however, there has been an enormous increase in the number of failures. This would seem to indicate a change in the insulators. The conditions appear to be the same as before with the exception, perhaps, of a slight increase of load on the system and would lead one to believe that the porcelain underwent fatigue. On the other hand, it has been definitely stated by engineers who have spent much study on the subject that a properly manufactured and designed insulator, that is, an insulator thoroughly fired and designed, such that no part is overstressed, undergoes no deterioration under continued service, but maintains the same characteristics independent of time.

Within recent years there has been a tendency towards increasing the factor of safety of line insulators. A small percentage increase in capital expenditure will give many times greater insurance against interruptions due to insulator failures and it is now universally recognized that although entailing some additional expense, the investment in extra line insulation yields a handsome yearly dividend in the way of reduction in maintenance costs and in shut-down expenses. The manufacturers of electrical porcelain are concentrating their efforts on the production of reliable ware and the designing engineers are co-operating with them in every possible manner towards the solution of the problems from the operating standpoint.

Recent Developments in Waterwheel Alternating-Current Generator Design

Waterwheel alternating-current generators of both the vertical and horizontal type are now universally built, machines of this type aggregating in capacity over three-quarters of a million kilovolt amperes having been manu-

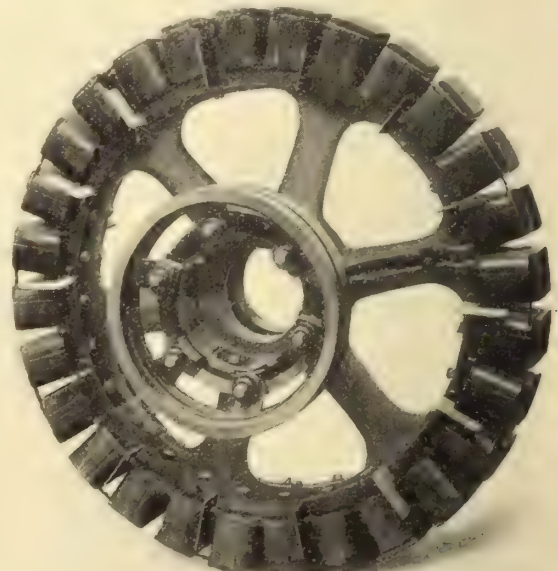


Fig. 1.

factured and placed in active, successful operation by one single company.

The speeds of waterwheel generators of any given capacity, but operating under different conditions, may vary so widely that a very considerable range of speeds must be covered by a complete line of generators designed for waterwheel drive. These conditions are entirely unlike those affecting engine driven generators which are built

for a comparatively few fairly well standardized speeds. It is therefore impossible for the manufacturer to have a complete design for every combination of capacity and speed that may be required, and it is not considered good engineering practice to use only one or two types of rotor con-

struction for machines covering the entire range of speed. As a consequence, numerous types of rotor construction have been developed, each one proven in service and standardized. Standard waterwheel generators are regularly wound for any of the following voltages:—240, 480, 600, 1,200 and 2,400. Units of 500 kv.a. capacity and larger are also standardized for higher voltages, usually 6,000v. Two-phase or three-phase windings are standard. For single-phase service, generators are supplied having three-phase windings and the single-phase load is carried by any two leads of the three-phase winding. When so connected, a

the wide range of speed and capacity to be covered. In general the centrifugal stresses are very much higher in rotors turning at high peripheral speeds than in rotors turning at low peripheral speeds. This condition is recognized by the manufacturer, and in developing their lines of waterwheel generators, it has been found expedient to adopt rotor construction of several different forms. Each is inherently adapted for certain speed and capacity ranges. The following brief description, with illustrations, have special reference to the principal Westinghouse types of manufacture.

The construction of Fig. 1, in which the poles are bolted to a rim of cast iron or steel spider, is adapted for the lowest peripheral speeds such as ordinarily obtain with very low heads of water.

Fig. 2 shows a construction wherein poles are dovetailed to the rim of a cast spider, which is adapted for almost any speed but is limited in its application because of the difficulty of promptly obtaining castings of large diameter. Cast steel spiders are usually required for this construction.

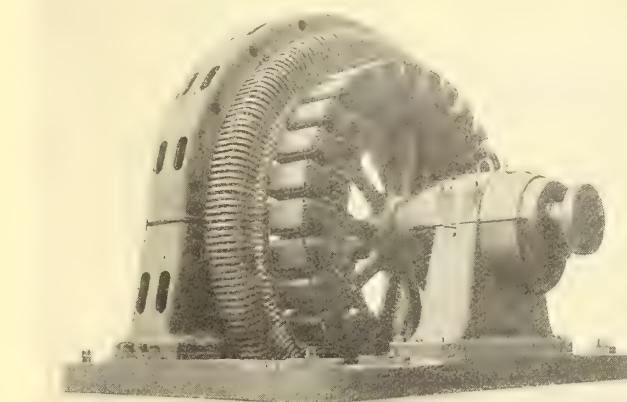


Fig. 4.

In a construction shown in Fig. 3, adapted for rotors of large diameter and high speeds a laminated rim is dovetailed to a cast spider and the poles are dovetailed to the rim. This construction is specially adapted for large diameters and high speeds. A cast steel spider, or the solid plate spider described below, would be satisfactory for these conditions provided the plates or castings of the requisite diameter could be readily obtained. The use of such large castings is, wherever possible, avoided, as they may introduce delays in manufacture.

In another construction that is adapted for the highest speeds, the spider is formed of laminations punched from sheet steel. The maximum diameter of such a rotor is determined by the maximum diameter of laminations that it is feasible to punch. Over 600 generators having rotors of this type are giving satisfactory service.

Rolled steel plates form spiders of the construction of certain types. The poles are dovetailed to the spider. This arrangement is best adapted for the highest speeds. It is evident that it would be practically impossible to increase the strength of this construction as the rolled steel is absolutely uniform in texture. It is, moreover, a readily-obtainable merchant material.

The poles for all these waterwheel generators are laminated. The field coils are retained on the poles by overhanging pole tips, and, where the stresses are high, by extra coil supports riveted to the sides of the poles.

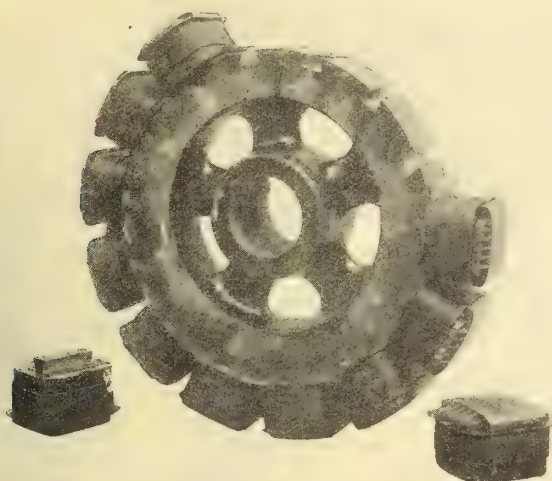


Fig. 2.

three-phase generator can be guaranteed to carry a single-phase load equal to 70 per cent. of its three-phase rating.

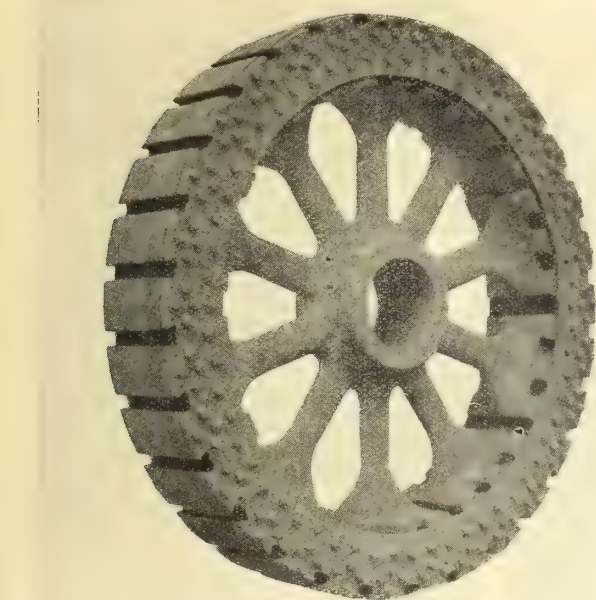


Fig. 3.

As stated above it is not consistent with economical and safe construction to use rotors of the same general design for an entire line of waterwheel generators, due to

Cast iron frames of modified box section, designed for maximum stiffness, support the punchings that form the armature structures of horizontal generators as shown in Fig. 4, which represents a horizontal type waterwheel generator with frame shifted to expose the rotor. Ventilating finger plates are inserted at intervals between the stator laminations and ensure cool operation. End plates of cast or wrought iron bind the laminations firmly in position in the stator structure. All armature slots are open and all armature coils are form wound, thoroughly insulated and interchangeable. The armature coils are effectively braced, wherever necessary, at the ends of the frames so that they cannot distort under the action of excessive currents.

Open or ventilating end-bells are used on the smaller

horizontal generators. These end-bells are built up from mild steel sections and are rigid and unbreakable. At the same time they are extremely open, assuring that air circulation and cooling air currents will not be materially obstructed. Enclosing end-bells are successfully used on some of the large high speed horizontal generators, as they serve to effectively direct the ventilating air and to minimize the hum incidental to the operation of large, high speed generators.

The above types of vertical generators are usually provided with two guide bearings. The bearings are babbitt lined and lubricated by a continuous flow of oil. The thrust bearing is ordinarily, though not always, furnished by the waterwheel builder as a part of his equipment.

The Month's Progress in British Columbia

Vancouver's New City Electrician

The position of city electrician of Vancouver, made vacant by the death of Mr. James A. McCrossan, has been filled by the appointment of Mr. W. T. Woodroffe, who for almost twelve years has been in the employ of the British Columbia Electric Railway, part of the time as superintendent

of mainland branches and latterly as acting electrical superintendent. The choice was made by the city council at a meeting held on January 8th. There was keen rivalry for the office, but the fire and light committee had previously sifted the qualifications of the dozen or more applicants and reduced the number of names to be considered to two—Mr. Woodroffe and Mr. W. B. Morgan, chief electrical engineer for the Northern Light, Power and Electric Company, of Dawson. The



Mr. W. T. Woodroffe

new city electrician has made a splendid record for himself since coming to Vancouver, and it is confidently expected that his work in the service of the city will add fresh laurels to a career marked by splendid initiative and executive ability.

Contracts Let for New Plant

On January 9 the management of the British Columbia Electric Railway Company, Limited, announced that awards had been made on tenders for the hydraulic and electrical equipment covering the proposed extension of the company's generating plant on the North Arm of Burrard Inlet. The plans for this undertaking represent an expenditure of approximately \$1,000,000, and the arrangements were made on the basis of the completion of the installation during the present year.

The company's present output at its North Arm plant is 43,500 horse power, which includes one unit of 10,500 horse power which was placed in operation on January 8. It also has a steam auxiliary plant in Vancouver of 12,000

horse power, one unit of 3,000 horse power at this station having been put into service during the latter part of December.

The plans for the development of the hydro-electric plant on the North Arm, for which contracts were awarded as noted above, call for an additional installation of 42,000 horse power at this point. This will give the company an available output of 85,500 horse power from this station which means the creation of a power station giving three times the amount of power furnished from any other present plant in Western Canada. The company has also recently awarded contracts for the enlargement of its steam auxiliary, making the plant available for an output of 20,000 horse power, and this work will be completed early this year. The combined power at its hydro-electric and steam plant which the company will have available at the close of 1912 is 105,500 horse power or over one horse power for every two persons within the area of Greater Vancouver, the city which is the centre of the company's operations on the British Columbia mainland. Viewing the situation in another way, as the company's territory on the mainland is roughly twenty by eighty miles, provision will be made for 66 horse power per square mile over the entire district.

In connection with the announcement the company states that plans are now in hand for the development of other power sites which will bring its total output up to 200,000 horse power.

The development of the North Arm plant will be carried on in connection with the construction of the dam at the mouth of Lake Coquitlam, 90 feet in height. This will give a storage capacity in Lake Coquitlam of 9,000 million cubic feet. During December the company completed the enlargement of the hydraulic tunnel connecting Lake Coquitlam and Lake Buntzen, from which latter point the North Arm generating plant is fed at a head of 400 feet. This tunnel was originally 9 feet by 9 feet, but has now been increased to 190 square feet on section.

The new equipment at the North Arm station for which contracts have just been awarded, consists of three units, each of 14,000 horse power. Messrs. John McDougall Company (Caledonian Iron Works), of Montreal, will supply the 14,000 h.p. waterwheels which will be of the Doble type. They will be the largest units of this kind in America. The electrical equipment will consist of three generators, each of 9,000 k.v.a. capacity and capable of overload to the maximum of the hydraulic equipment.

The three new units will be housed in an independent generating station, located on the waterfront of the North Arm at a point about 2,000 feet south of the existing generating station. To convey the water from Lake Buntzen

to the station a hydraulic tunnel will be driven through solid granite. This tunnel will be 2,250 feet long, with an internal diameter of 15 feet 6 inches and concrete lined throughout to lower the friction factor to the lowest possible point.

Mr. Thomas Goes to Nelson

Mr. Herbert P. Thomas, the newly appointed superintendent of the electric light and power department of the corporation of the city of Nelson, is another Englishman who has chosen to throw in his lot with the electrical industries in Canada. Mr. Thomas chose a rather circuitous route in coming to Canada by way of Australia where much of his earlier education was obtained and where he attended the University of Melbourne for 2 years. In 1904 he finally reached Canada and entered McGill University in the third year obtaining his B.Sc. degree in electrical engineering the following year. In Australia he had had considerable experience with the Melbourne City System, and on graduating from Montreal accepted the position of erecting engineer for the Allis-Chalmers-Bullock Co. Two years later he resigned this position to become manager of Public Utilities of the town of Kenora. It was with much regret that his resignation from this position was accepted last December in order that he may assume his present office of superintendent in Nelson. Judging by the progress made in Kenora, Nelson is wise in securing a man of Mr. Thomas' ability at the present stage of that busy town's industrial growth.



Mr. Herbert P. Thomas

Calgary's New Pumping Plant

There has recently been installed at the Calgary water-power plant a 750 kw. mixed-pressure Curtis turbo-generator, 1,800 r.p.m. The unit is complete with a Wheeler condenser, a Wheeler centrifugal pump, a Wheeler-Edwards air pump and a 75 kw. interpole exciter direct connected to a 13 x 14 horizontal Robb-Armstrong engine. The turbine runs on low pressure steam from one 500 kw. and one 350 kw. reciprocating engine set, though at present high pressure steam is being used and the engineer in charge of the plant informs us that it fires quite as easily up to 400 kw. and more economically up to full load than the reciprocating engines, with the additional advantage that they save cylinder oil and require very little attention.

The following temperature readings were taken on the condenser under a 700 kw. load,—exhaust steam in condenser, 87° F.; outgoing circulating water, 82° F.; incoming circulating water, 34° F.; condensate, 52° F. The above readings compared with a 30 inch barometer works out to 28.7 inches of vacuum with both pumps running slower than they are designed for to carry full load.

Live steam is at 150 lbs. and is superheated to about 150° F. The equipment is reported as giving excellent satisfaction and standing well within the guarantee, the generator rising only 35° C., as compared with a guarantee of 50° C.

The electrical equipment was supplied by the Canadian General Electric Co.

Stave Lake Plant Operating

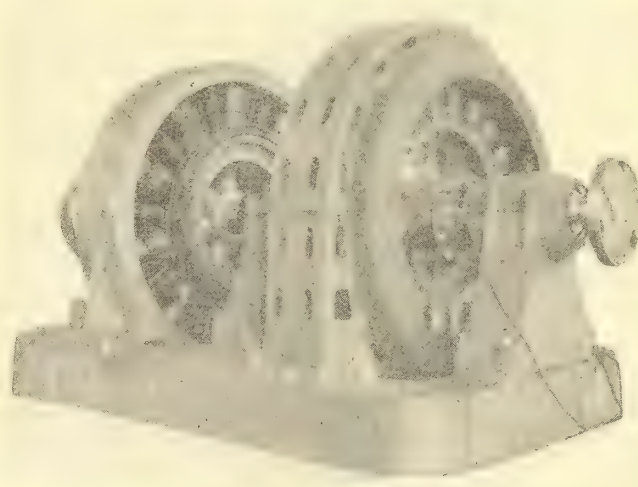
The first large turbine installed by the Western Canada Power Company at Stake Lake, 35 miles from Vancouver, was started up on December 17th last and power is now being supplied to Mission, Vancouver and New Westminster. The units installed are probably the largest, except the Niagara plants, ever installed in Canada. In addition to the contract for about 5,000 horse-power with the Whatcom Railway & Power Company, now operating in the State of Washington, and one other contract with a local concern for 1,000 horse-power, now being completed, the company starts with actual contracts aggregating 4,500 horse-power connected, of which two thousand horse-power will be supplied in the vicinity of Mission; and there are certain other immediate customers amounting to 1,000 horse power. The company also have prospective customers amounting to from 15,000 to 18,000 horse power connected load additional. Apparently the prospects of the company are excellent.

A Record Installation

What is considered to be a record for the erection and installation of heavy electrical machinery in this country, at least in the west, was accomplished by the B. C. Electric Ry. Co. at Vancouver in December last, when a 1200 kw. synchronous motor-generator set was completely installed within 84 hours after the apparatus was delivered to the company's substation siding.

The motor-generator, an illustration of which is herewith reproduced, was built by the Crocker-Wheeler Co. at their Ampere N.J. works, the manufacture of which was also accomplished in record time, the order having been placed Oct. 12th and shipment made Nov. 25th. As above noted the unit has a capacity of 1200 kw. at 600 volts d.c. the motor being wound for three phase 11000 volts with a rated capacity of 1370 kv.a. The whole set weighs 140,000 lbs.

The generator is used in connection with several rotary converters to supply power for the railway system of the company, and a special effort was made by the company's engineers to have it in service before the heavy Christmas loads. To this end work was pushed ahead unceasingly



Synchronous Motor-Generator for B.C.E.R.

and no time or expense spared to have it installed in time. It is interesting to note that the erection and installation was accomplished in such a short space of time, particularly as the machine was set up in a temporary addition to the existing station, and without the use of a crane to

handle the heavier parts of the set, all these having to be moved and set up by means of hand tackle and jacks.

The work was under the personal supervision of the company's electrical engineer, Mr. J. B. Ingersoll, assisted by the superintendent of electrical construction, Mr. D. R. Kennedy and designing engineer, Mr. G. A. Booth.

Contract Awarded at Puntledge River

Plans submitted by the Wellington Colliery Company, of Victoria, for the generation of electric power at Puntledge River, a tributary of the Courtney River entering Comox Lake, were recently approved by the Lieutenant-Governor-in-Council. The company hold two water licenses permitting the diversion of 1,000 cubic feet of water per second, and propose to construct an impounding dam on the Puntledge River near the outlet of Comox Lake, and a diversion dam about 2,800 feet below this impounding dam. Work on the dam and generating station will commence on or before May 1st next and the plant must be in actual operation on or before December 31st, 1913. The contract has been awarded to Grant, Smith & Company, engineers, Victoria.

Miscellaneous Western Notes

New Westminster city council has authorized an extension of the cluster lighting system.

Victoria city council has authorized the purchase of a motor patrol wagon, the cost to be \$3,000.

Fire Chief Jordan, of South Vancouver, is preparing plans for a fire alarm system for the municipality.

The city power house and electric plant at Vernon, B. C., were destroyed by fire on the night of January 15th. Loss covered by insurance.

The ratepayers of Kamloops will early in the new year be asked to approve an expenditure of \$240,000 on the Barrier river hydro-electric power scheme.

Nelson city revenue from the municipal light and power plant is expected to reach a total of \$60,000 for the past year, as compared with \$50,155 for 1910.

With the arrival of an additional plant from the east, work on the installation of the underground conduit system for the municipal street cluster lighting system in Victoria, B. C., is being rushed.

The double wiring of the line between Merritt and Spence's Bridge, B. C., and the latter point and Vancouver, has been completed by C. P. R. linemen, thus making it possible for these places to keep in touch with the terminal city.

The low rates for electric power being offered by the Western Canada Power Company to the municipalities served by the company's power line from Stave Falls will it is expected, greatly stimulate the location of industries along the route.

Lulu Island, near the city of New Westminster, B. C., will be on terms of equality with the rest of that city's suburbs as regards distance from the centre of the town when the new car line, now under construction to Queensborough is in operation.

An address on dielectrics and insulators was given by Mr. J. G. Lister at a recent meeting of the B. C. E. R. Co. section of the National Electric Light Association. Mr. Lister was asked to lecture again before the section at one of its spring meetings.

G. H. Franklin, former manager of the Lulu Island branch of the B. C. E. R., who has been promoted to the management of the interurban system, was presented with a handsome gold watch, chain and locket, suitably inscribed, by the employees of the Lulu Island branch, prior to assuming charge of his new duties on January 1st.

E. L. Keiser, electrical engineer with the Westinghouse Company, Pittsburg, Pa., recently was appointed inspector of the Canadian Pacific Railway branch between Castlegar and Rossland, B. C., in connection with the proposed electrification of that portion of the company's system. A sub-station will be located either at Rossland or Trail.

Prof. Mead, engineer in charge of the Bull River power development plant, located on the Bull River, between Wardner and Fernie, is planning a six-strand duplicate power line carried on steel towers from the plant over Lizard Pass to Fernie and on to the coal mines at Frank, Alberta. Machinery to generate 10,000 h.p. will be installed in the early spring by the new owners, M. A. Devitt and H. W. McCay, of Chicago. The power line is expected to reach Fernie by January 1, 1913.

The Provincial Government has been asked to straighten out some difficulties which have arisen between the citizens of Ashcroft and the Ashcroft Water & Electric Light Company. It is charged that the company's rates are too high, and that the manager takes the position that he will not supply electric light to those who do not take water from his company. A letter from the company's solicitor gave a different version of the trouble, which will be investigated and dealt with by the Attorney-General's Department.

A host of friends learned with regret of the news of the transfer of Mr. J. Fletcher, superintendent of C. P. R. telegraphs for British Columbia to Montreal. Mr. Fletcher has spent many years in the west, and has contributed his share to the growth of Vancouver from town size to metropolitan proportions, and of North Vancouver from an Indian village to a city. His ability as a telegraph engineer was actively applied to the improvement of the Vancouver service when he assumed the superintendency a year ago. This accomplished, he began planning new facilities, including a second wire to Ashcroft, which was recently completed, perfecting a service long needed.

The quashing of the Point Grey tramway by-law under which the British Columbia Electric Railway Company had been operating its service in that municipality led to the prompt suspension of the service. One of the reasons for quashing the by-law was that the privilege of running passenger and freight trains in the municipality being assignable, it might result in the franchise being assigned to fifty different persons and Point Grey being turned practically into a railway yard. The company had also the exclusive, or at least the prior right, to select a particular street within five years, and use it for 99 years. A new agreement will no doubt be framed up, but it may take some time to arrive at a working basis.

Activity in the Province of Quebec

Annual Dinner of Quebec Electrical Association

About 150 guests and members of the Electrical Association of the Province of Quebec were present at the annual dinner held on January 11 in Montreal. Mr. N. Simon-eau, the president, occupied the chair, and was supported by Dr. Guerin, the mayor; Messrs. Jas. Ballantyne, president of the Builders' Exchange; Jas. Bennett, Chief Inspector of the Canadian Fire Underwriters' Association; Clarence Thomson, vice-president of the Association; W. B. Shaw, treasurer; R. E. H. Jones, Imperial Wire and Cable Company; H. D. Crouch; G. H. Onley, Manager of Philips' Electrical Works, Limited; Ald. Leslie H. Boyd; K. B. Thornton, Canadian Light, Heat and Power Company; Chas. F. Medbury, Canadian Westinghouse Company; W. J. Doherty, Northern Electric and Manufacturing Company; R. J. Hiller, Canadian General Electric Company; Geo. Knott, Benjamin Electric Manufacturing Company, of Toronto; W. P. Baird, Montreal Light, Heat and Power Company; J. A. Dawson, Dawson & Company, Limited; E. W. Sayer, Sayer Electric Company; L. Rousseau, vice-president, and R. M. Lynch, secretary of the association; J. A. Valois, J. A. Hicks, F. J. Parsons, R. Moncel, S. W. Smith and M. Rubenstein.

Letters of regret were read from Sir Lomer Gouin; Major G. W. Stephens, president of the Montreal Harbor Commissioners; R. M. Wilson, of the Montreal Light, Heat & Power Company; J. H. Lauer, secretary of the Montreal Builders' Exchange; Elihu Thomson, Swampscott, Mass.; W. H. Merrill, manager of the Underwriters' Laboratories, Chicago; F. H. Wentworth, secretary of the National Fire Protection Association, Boston, and Thomas A. Edison.

The toast of "Our City and Province," was proposed by Mr. L. Rousseau, and replied to by the Mayor, who spoke of the assistance given to technical education by the Provincial Government and the city. His Worship also referred to the immense progress made in electrical science, pointing out that until the last few years they had no idea of the potentialities of electricity; even now, he said, they had only commenced to learn the value of the science. Montreal had a population of over 600,000, but he was anxious that it should soon reach the million mark, because they wanted underground electric cars, and no city could support such a system without that population, having regard to the expense of the traffic and the return on the capital invested. He had no doubt that Montreal would ultimately secure such a system. The C. N. R. intended to electrify the line they were to build into the city, and Sir Thomas Shaughnessy had told him a short time ago that it was only a matter of a few months before the C. P. R. would commence to electrify their roads into the city; the Mayor added that he hoped the G. T. R. would follow the same course. His Worship concluded by a reference to the value of such institutions as the Quebec Electrical Association.

"Our Guests," proposed by Mr. Clarence Thomson, was responded to by Ald. Boyd, chairman of the arbitration committee of the association, who referred to the fact that his office was a sinecure, owing to the absence of disputes among the members.

Mr. James Ballantyne, who also spoke, regretted that the association had withdrawn from the Builders' Exchange, and hoped the members would return, on the ground that it was desirable to form as strong a body as possible. The Builders' Exchange was doing good work in the way of preparing a model contract which would be fair to architects,

contractors and proprietors. Other speakers to this toast were Mr. Bennett and Mr. Hiller.

In proposing "Manufacturers and Jobbers," Mr. Crouch dealt with the necessity of the jobber, who saved expenditure in the selling force of the manufacturer by selling the products of the latter. Manufacturers could not always maintain a sufficient force, and here the jobber came in. It was sometimes hard for the dealer and contractor to realize that the jobber was entitled to his selling profit, but were it not for the jobber the manufacturer would have to increase prices owing to extra expenses at the selling end.

Mr. Jones responded, and remarked upon the good which resulted from men in the trade—although competitors—associating and exchanging ideas.

Compulsory Inspection Favored

The President spoke in favor of the city licensing electrical contractors, so that there would be a guarantee that the work was properly done. He also advocated compulsory inspection of wiring, etc. The association now numbered 60 members.

The Mayor, in reply, stated that the new by-laws contemplated a more efficient inspection, but the position had not yet fully developed.

"Our Association" was proposed by Mr. Bennett, who dwelt at length with the question of the inspection of wires, etc. Mr. Bennett said it was impossible to make progress in this direction unless every one in the electrical trade co-operated, and he was glad to say he had had that co-operation. The inspectors' work was at all times difficult, as so many interests had to be considered. The contractors in Montreal were as good as any on the American continent. Mr. Bennett went on to speak of the great improvement in inspection that had taken place during the last four years, and in view of this he regretted that it was desired to have other inspection.

The President explained that Mr. Bennett had misapprehended his remarks. He fully appreciated the value of Mr. Bennett's work. What he (the president) wanted was simply compulsory inspection, enforced by the city, not that the city should do the inspecting.

The Mayor remarked that it was simply a question of legislation, and he did not see why a by-law should not be passed requiring the work to be done compulsorily.

Alderman Boyd also commented on the good work done by Mr. Bennett, and was of opinion that the city should pass a by-law as desired by the President. This would certainly strengthen the hands of the Underwriters' Association.

Mr. Bennett, outlined a scheme of inspection similar to that in New York city, where, owing to the appointment of two boards of inspection, chaos formerly resulted. That had been changed, and now there was only one inspecting authority—the fire underwriters. He suggested the appointment of a committee of three, representing various interests, to whom an appeal could be made if it was considered that an unfair decision had been made. Satisfactory results, he believed, would follow, as he did not think it right to leave the entire decision in the hands of one man.

Mr. Shaw, also replying to the toast, said that the withdrawal of the Association from the Builders' Exchange had been purely for financial reasons. He thought a by-law for compulsory inspection would strengthen the fire underwriters' hands.

Mr. J. A. Valois and Mr. Thornton also replied. The latter, as a power man, welcomed compulsory inspection.

He preferred that the inspection of the Fire Underwriters should be obligatory, as then they had the assurance that the wiring was satisfactory and that everything had been done for security.

3-Mile Tunnel Through Mount Royal

The engineers of the Canadian Northern Railway have submitted to the Montreal council plans for an electric railway, costing, with terminals and other facilities, an approximate sum of \$25,000,000. The great feature of the scheme is a tunnel through Mount Royal; this will be three miles long, and with the additional underground approaches will be the longest tunnel in Canada. The tunnel will be about 30 feet wide and 25 feet high. There will be a decline in the grade of the tunnel itself, from the north end to the mouth, of about 32 feet to the mile; consequently the mouth of the tunnel will be about 100 feet lower than the entrance. The electrification of the line will commence at Back River, the track to the point where it enters the tunnel being raised on an ordinary earthen embankment. If necessary double tubes will be constructed through the mountain. At the city end of the tunnel a viaduct to the harbor front will be constructed of steel and concrete. Only the tops of the cars will be seen from the street. A large station and hotel are parts of the scheme. Provision has been made for connecting with any future system of underground lines which may run from east to west through the city.

Although not definitely settled, it is probable that an elevated track along the front of the harbor will be built. A branch freight line will run from St. Lambert to Longue Pointe, along the northern and eastern portion of the island, also connecting with the present station in the east end. The company's shops are to be located behind the mountain, and a model city is also being planned there.

In connection with the above an application has been made at Ottawa for the incorporation of the Canadian Northern & Terminal Company, Limited.

Staff Changes on C. P. R. Telegraph System

Several changes in the staff of the C. P. R. telegraph system have been made. Mr. W. J. Camp, manager of the electrical department, is made assistant manager of telegraphs, the other appointments being—Mr. F. J. Mahon, superintendent of the Eastern division, with headquarters at Montreal; Mr. J. Fletcher, superintendent of traffic, with headquarters at Montreal; Mr. W. M. Godsoe, superintendent of the Atlantic division, with headquarters at St. John, N.B.; Mr. D. H. Bowen, assistant superintendent of the Ontario Division, with headquarters at Toronto; Mr. John Tait, assistant to the general superintendent, with headquarters at Winnipeg; Mr. John McMillan, superintendent of the Manitoba division, with headquarters at Winnipeg; Mr. R. N. Young, superintendent of the Saskatchewan division, with headquarters at Moose Jaw; Mr. Donald Coons, superintendent of the Alberta division, with headquarters at Calgary; Mr. J. F. Richardson, superintendent of British Columbia division, with headquarters at Vancouver. The position of superintendent of traffic is a new one, and Mr. J. Fletcher, who fills it, has been superintendent of the British Columbia lines.

Tramways Co. Wants Amended Charter

The Montreal Tramways Company is promoting, in the Quebec Legislature, a bill for amending its charter so as to regulate the conditions under which the company may acquire all the shares in the capital stock of any other company, in the market or otherwise than from such company, and in case of such acquisition how the company shall exercise and enjoy the franchises, concessions, rights, privileges and assets of such company. It has been rumored,

especially in the Stock Exchange, that a scheme is being prepared for the amalgamation of the Tramways Company and the Canadian Light & Power Company by means of a holding company with a capital of 20 million dollars and an English charter. At present the control of both concerns is held by the same capitalists. Mr. E. A. Robert, the president of the Tramways Company, Mr. Duncan McDonald, general manager, and Mr. Perron, K.C., have had a long consultation with a committee of the City Council as to the changes in the service. Alterations in the running arrangements, new lines, and stops were agreed upon.

Acquired St. Paul L. & P. Co.

The interests which control the Canadian Light & Power Company and the Montreal Tramways Company have obtained control of the St. Paul Electric Light & Power Company, Limited. The purchase price includes the plant and an exclusive franchise in the municipality of Emard, which is now a ward of the City of Montreal. The Canadian Light & Power Company has been gradually extending its borders by purchasing small electric light and power companies and has secured some big contracts for power. This company is now furnishing current to the St. Paul Company. The Board of Control have notified the St. Paul Company that under the contract with the city they claim a reduction in the price of lighting.

Extending 11,000 Volt Line

The Saraguay Electric and Water Power Company is rushing the construction of a 11,000 volt transmission line from the terminal station of the Canadian Light and Power Company to its own sub-station in Cote des Neiges. As soon as completed, the company will purchase power from the Canadian Light and Power Company under the terms of a contract made a short time ago. The new transmission line will replace a temporary line made after the Saraguay's power house was partially destroyed by fire in December.

Long Sault Bill Up Again

Plans for the proposed Long Sault dam are now ready, and another effort will probably be made to get parliamentary sanction to the scheme. According to Mr. L. A. Whitsit, one of the resident engineers of the Long Sault Development Company, Massena, N.Y., the plans provide for an expenditure of about \$40,000,000, by which from 500,000 to 700,000 horse power can be developed for transmission over Eastern Ontario and Western Quebec. The plans have been drawn up in accordance with the restrictions suggested by the United States and Canadian Government engineers. The lift-lock in the plan would be the largest in the world.

Miscellaneous Notes from Quebec

Mr. W. I. Gear, Montreal, a member of the committee to investigate the effect of power development on the St. Lawrence River navigation, has resigned from that body.

Shareholders in the Shawinigan Water & Power Company have authorized the issue of \$500,000 debentures. The issue has been sold in London at par and interest.

Mr. N. Simoneau, president of the Province of Quebec Electrical Association, was a guest at the annual dinner of the Builders' Exchange, Montreal, on Jan. 9.

The Montreal Light, Heat & Power Company, Montreal, has offered to extend its system to Greenfield Park, near St. Lambert, on the south side of the St. Lawrence,

opposite Montreal, on condition that a given number of inhabitants agree to use the service.

A 1200 kw. railway motor-generator has been purchased by the Montreal Tramways Company from the Canadian Crocker-Wheeler Company.

The Dominion works of the Canadian Car and Foundry Company are now being supplied with power by the Canadian Light and Power Company.

An amateur wireless telegraphy association, with the title of the Wireless Association of Canada, has been formed in Montreal, with the object of banding together for mutual benefit, amateurs interested in the science.

Mr. Arthur M. Irvine, of Windsor avenue, Westmount, is the vice-president and managing director of the Canadian Electric Welding Company, Ltd., just registered in Montreal.

The Montreal council has decided to seek legislative powers for constructing and operating or leasing underground tramway lines, the cars to be operated by electricity or other power.

The Canadian Light and Power Company, Montreal, has placed orders with the Canadian General Electric Company for several automatic voltage regulators to be used on its distribution system in Montreal.

Through Mr. G. Fort, the executive of the Union Pacific Railway Company have presented to McGill University a working model of the electrically operated automatic block signals in use on the Union and Southern Pacific lines. The model has plate glass sides in order to show the mechanism.

The Montreal Light, Heat & Power Company has applied to the Provincial Legislature for power to issue debentures, debenture stock, share warrants, and other securities, to guarantee the obligations of other companies, and to establish or aid pension funds or other benevolent or useful institutions.

The Lachine Council has asked the Department of Railways and Canals, Ottawa, for permission to construct towers on the canal banks for the purpose of carrying the electric wires over the canal, and doing away with the present submarine cable, which is in constant danger of being snapped by passing boats during the summer season. These towers will cost \$6,000, and will save an annual outlay of \$700 on the repair of cables.

Mr. Justice Charbonneau, Montreal, has refused an application for an order to produce an accident report made to the Montreal Tramways Company by a conductor. It was claimed by the company that the report of the accident, in which a passenger was killed owing to collision between two cars, was made on a special form for the information of the company's solicitors, and was consequently confidential. The judge held that it was too early to produce the report.

Following up the policy adopted some time ago, the Montreal Light, Heat & Power Company this year construct additional conduits for their cables, which are now chiefly overhead. The company has just contracted with the Canadian British Insulated Company and Helsby

Cables, Limited, for the supply of cables of a value of between \$170,000 and \$200,000. When these are installed the Light, Heat & Power Company will have nearly half of its main feeders under ground.

According to the annual report of the Montreal Telegraph Company, the property of the company is valued at \$2,151,823. Dividends for the year totalled \$165,000. The company is operated and maintained by the G. N. W. Its operation and maintenance is also guaranteed by the Western Union under an agreement for 97 years from the 1st of July, 1881, which also guarantees payment of the dividends. Mr. William Wainwright has been elected director in the place of the late Mr. Edward Rawlins.

Mr. Walter J. Jones has been appointed engineer to advise and superintend the construction of the underground conduits for overhead wires in Montreal. Mr. Jones has recently been superintending the construction of conduits at Reading, Pa. The city will ask the provincial government for additional powers by which the commission will be able to prepare separate parts of their scheme and put them into operation when approved by the Public Utilities Commission. All compensation is to be fixed by the Conduit Commission, subject to an appeal to a court of law.

New Books

Modern wiring diagrams and descriptions for electrical workers,—by Henry C. Horstmann and Victor H. Tousley. Frederic J. Drake & Company, Chicago, publishers. A hand book of practical diagrams and information for electrical construction work, showing all that ordinary electrical workers need under average circumstances. Third edition, revised, enlarged and illustrated.

Modern American Telephony,—Frederic J. Drake & Co., Chicago, publishers. Edited by Arthur Bessey Smith, E.E. Price \$2.00. The book covers modern telephony in all its branches including the theory, construction, installation, operation and maintenance of telephones. A chapter is given to wireless telephony, also a chapter to the automatic system of telephone operation.

The Operating and Testing Manual—by Henry C. Horstmann and Victor H. Tousley. F. J. Drake & Company, Chicago, publishers. A hand book for men in charge of electrical apparatus, for repair men, trouble men, lamp trimmers and electricians generally. This book is well illustrated and will be found of great assistance to the average central station engineer.

Electrical Construction—by Henry C. Horstmann and Victor H. Tousley. F. J. Drake & Company, publishers, Chicago. A practical guide for the beginner in electrical construction work, showing the latest approved methods of installed work of all kinds according to the rules of the National Board of Fire Underwriters. These rules are appended. The book is well illustrated, well bound and contains much valuable information not only to the beginner in electrical construction but to the experienced workman as well.

Financial Review,—The regular appendix to the Annual Financial Review compiled by W. R. Houston, of Houston's Standard Publications, King street east, Toronto. This is the appendix gotten out yearly each November containing reports of companies whose annual meetings are held and general statements published after the regular volume is compiled in April. It contains much information about the financial side of a number of electrical operating companies and is always exceedingly interesting to the electrical man.

Winnipeg and the Middle West

Winnipeg Electric Railway Extensions

Among the extensions which will be made during 1912 by the Winnipeg Electric Railway Company will be the erection of additional sub-stations to care for the rapidly growing railway load in all parts of the city. Tenders have been called for the following equipment for these extensions,—one 1,200 kw. three-bearing motor-generator set, comprising 2,300 volt synchronous motor, exciter and 550 volt direct current interpole generator; a two-panel switchboard and all necessary instruments and starting devices for starting set from either a.c. or d.c. side. This set will be placed in the old steam plant on the Assiniboine River near Main street and will help to carry the heavy downtown railway load. There will also be a similar set of 1,000 kw. capacity and with a four-panel switchboard, located in a new station to be built in the northwestern part of the city, and which will supply power for the heavy railway load from the various industrial plants in that quarter and from the Exhibition grounds in mid-summer. Another 1,000 kw. unit with four-panel switchboard will be added to the present St. James station on the western edge of the city. There will also be erected adjoining this station, a transformer station with a present capacity of 1,500 kw. in 500 kw. 2,300/13,200 volt oil insulated self-cooled units, so that the total capacity of this sub-station will be 3,500 kw. Power will be transmitted from this station over a three-phase 13,200 volt line five miles long to the plant of the Canada Cement Company, where there will be installed a step-down station of 1,000 kw. present capacity in the same type of transformer that will be installed at the step-up station. The transformers will be connected in open delta at present, and a third transformer will be added to this station equipment as the load increases. The third transformer at the step-up station will be used as a spare for the present. As the step-down station will have no operator, multi-gap lightning arresters will be used, and a minimum amount of switching equipment consistent with the safe and reliable operation of the plant will be installed.

Street Railway for Lethbridge

Following the passing of a by-law to expend \$450,000 on street railway and auxiliary equipment contracts were let some time ago for Babcock & Wilcox boilers and for a Willans and Robinson-Siemens turbo-generator. Contracts for further equipment to cost some \$200,000 in connection with the railway itself have been awarded as follows:

Intersections,—to the United States Steel Products Co., Winnipeg, \$32,738.

Rails, angle bars, bolts, &c.,—to the United States Steel Products Co., \$62,883.

Ties,—to the Lindsley Bros., Calgary, \$19,250.

Rail bonds,—to the Ohio Brass Co., of Mansfield, O., \$1,665.

Cars,—to the Preston Car & Coach Co., five 41 ft. 6 inches with Brill trucks and five 32 ft., 10 inches with Taylor trucks, \$40,158.

Motor and air brake equipment,—to the Canadian Westinghouse Co., Hamilton, \$19,755.

Wooden poles,—to Lindsley Bros., \$810.

Steel poles,—to the United States Steel Products Co., \$2,887.

Line material,—to the Ohio Brass Co., \$435.

Sundries,—including insulators, strain plates, guy wire,

&c., to the Western Supply & Equipment Co., Lethbridge, \$1,413.

Sundries,—including trolley frogs, angled crossings, trolley splicers, &c., to the Canadian General Electric Co., \$411.

Copper wire,—to the General Supplies Co., Calgary, and to the Northern Electric Co., of Calgary, \$9,724.

Lightning arresters,—to the Canadian Westinghouse Co., \$83.

Generating Apparatus for Lethbridge Street Ry.

In connection with the street car system to be installed next year in Lethbridge, Alta., the Siemens Companies will supply the following apparatus:—one 2-phase turbo-generator, 1,500 kw. capacity, 3,600 r.p.m., 2,200 volts, 60 cycles, direct-connected to a Willans and Robinson high pressure turbine; one 400 kw. motor-generator set consisting of one d.c. compound wound generator fitted with commutation poles direct-coupled to and mounted on combined bedplate with one self-starting synchronous motor, with exciter. Output of generator, 400 kw., 550/605 volts. Output of motor, sufficient to drive above generator and also for power factor correction when running on a 2-phase, 60 cycle, 2,200 volt supply. The order also includes one motor generator set of 200 kw. capacity, otherwise as above; one 50 kw. d.c. 125 volt generator, direct-connected to a high speed Belliss and Morcom vertical engine, and one 6-panel switchboard. All this electrical apparatus will be made at the Stafford, England, works of the Siemens Bros.' Dynamo Works.

Regina Equipment on the Way

The new turbo-generator for the Regina power plant is reported to have undergone tests at the British factory and to be now on the way. The specifications are as follows: one 1,500 kw., 3-phase, 60 cycle, 1,200 volt, 1,800 r.p.m. turbo-generator, direct-connected to a Willans and Robinson high pressure steam turbine; one 400 kw., d.c. compound-wound generator 550/600 volts, 350 r.p.m. direct-connected to a high speed Belliss & Morcom vertical engine; switchboards comprising seven panels for controlling the above generators and feeders. This electrical apparatus is all supplied by the Siemens Companies.

Competition Still the Life of Trade

The following communication has been received from one of our Winnipeg readers who evidently is possessed with the proper amount of western pride. We humbly apologize to the extent of ten feet high and about two feet wide.

"There is an item in your January issue re the tallest stack in Canada that needs correcting. We rather pride ourselves in Winnipeg on having the tallest stack as well as the best steam auxiliary plant north of the line, and naturally do not feel inclined to let our Vancouver friends put on airs about their 8,000 kw. plant and 240 foot stack, while our plant is of 12,000 kw. capacity with a stack 250 feet high and a much larger diameter."

The Canadian Tungsten Lamp Company, through their representative, Mr. Alvan Woolf, have secured a large lamp contract from the city of Winnipeg.

Gasoline Motor Car for Winnipeg City Line

The city of Winnipeg has recently purchased a gasoline motor car for use on their private railway between the C.P.R. station at Lac du Bonnet and the power-house at Point du Bois. The illustration of the exterior of the car shows its general features. It has a four wheel steel frame truck with ten foot wheel base, standard gauge, and the total weight is about 22,000 pounds. Power is supplied by a heavy type four cylinder gasoline engine of special design and with a conservative rating of 50 to 60 h.p. at 600 r.p.m. The transmission is of a gear type and is so designed that there is no possibility of gear trouble in changing from one speed to another. There are three speeds in each direction, and two chains transmit the power from the gear box to the front pair of wheels. The maximum speed so far obtained is 42 miles per hour, but on good track this can be considerably increased. With this car the



Gasoline Motor Car for Winnipeg City

travelling time between Lac du Bonnet and Point du Bois has been decreased from one hour and thirty minutes (the schedule time of steam train) to fifty-five minutes, the present schedule. The gasoline consumption is from 7 to 8 miles per gallon. The car has hauled with ease a loaded forty ton freight car, and has taken a 5 per cent. grade $\frac{3}{4}$ of a mile long on the high gear. There is seating capacity for 35 people, the body being divided into two compartments, the rear having reversible seats upholstered in rattan and the forward containing engine and having ample room for light baggage and express. It may also be used as a smoking compartment as it is provided with drop seats. Steam heat is supplied from a small boiler at the front end of the car. Westinghouse straight air equipment is provided. The car was built by the Sheffield Car Co., Three Rivers, Michigan and supplied by the Canadian Fairbanks Co.

Edmonton Adds 2500 kv.a. Generator

The city of Edmonton has added to its municipal plant a 2,500 kv.a. Westinghouse-Parsons turbo-generator unit complete. The generator is 3-phase, 2,300 volts, 60 cycles. The Canadian Westinghouse company is also supplying for use with the generator, a 100 kw. motor-generator exciter set with the necessary switchboard instruments.

The recent elections for the appointment of the various sub-committees which together form the Conference Committee of One Hundred of the Board of Trade of the city of Toronto resulted in the naming of Messrs. M. S. Pierce, Walter Warren, and C. H. Willison representing Electrical Concerns, and Messrs. K. L. Aitken, Arthur Hewitt and Noel Marshall representing Fuel, Lighting and Power.

Trade Publications

X Cells.—New price list and re-sale schedule on X Cells issued by the Canadian Carbon Co., 96 King street west, Toronto.

Magneto Test Set.—Pamphlet No. 35 issued by the Stromberg-Carlson Telephone Co., from their Toronto office, descriptive of Code No. 844 Magneto Test Set for Linemen.

Floor Outlets.—Bulletin E issued by the Steel City Electric Co., Pittsburg, Pa., describing water tight floor outlets. Also catalogue H on stamped steam outlet boxes, by the same company.

Arc Light Carbons.—A new bulletin and price list issued by the Canadian Carbon Co., Ltd., Toronto, covering their flame arc, enclosed arc and moving picture machine carbons, together with much interesting information in the same connection.

Street Fixtures.—Bulletin F, by the Canadian General Electric Company, describing 'Wheeler' Mazda street fixtures of various types; well illustrated. The same company has just issued a small sheet describing the Hart & Hegeman struck-up plates for push and rotary flush switches.

Oil Circuit Breakers.—Folder 4213, issued by the Westinghouse Electrical & Manufacturing Company, descriptive of types B, F, H and J Wire Circuit Breakers, covering a wide range of voltages and capacity. These breakers are for switch-board or wall mounting, either hand or electrically operated.

Kerr Turbines.—Catalogue No. 19, just issued by the Kerr Turbine Company, Wellsville, N.Y., through their Canadian agents, the John McDougall Caledonian Iron Works Company, of Montreal. The catalogue illustrates the construction of the Kerr turbine and shows a number of interesting installations now in operation.

Veritys Ltd.—List catalogues as follows: No. X147, radiant lanterns for tungsten and carbon lamps; X148, Aston tungsten lamps; X149, farm house lighting sets, with or without gasoline engines, and varying in capacity from 28 to 225 twenty-watt lamps; X155, 'Astonlite' for shop window light. This apparatus is all English made.

Sterling Publications.—The Sterling Telephone and Electrical Company, Limited, of London, England, have issued the following pamphlets:—No. 157, Parlyphones, a portable telephone for private house use; No. 159, Electric Blasting Machines, descriptive of electrical apparatus and methods of exploding blasting charges; No. 173, Primax Automatic Interphones, for use in large public buildings, business houses and factories; No. 177, Unitype Indicators.

T. T. C. Tungstoliers.—An illustrated catalogue issued by the Tungstolier Company of Conneaut, Ohio, briefly describing the unique features embodied in T. T. C. Tungstolier separable lighting fixtures. Opportunities are afforded by these fixtures, due to an easily effected interchange of their parts, for evolving various styles or types of fixture to suit the individual taste or the architectural requirements of any specific lighting installation. By means of a cut-leaf method employed in the catalogue in illustrating the various parts, 648 different assembled views of a 2-arm fixture are made possible by merely re-arranging and turning the 4-cut sections on which the parts are pictured.



Fig. 1. British Columbia Three Car Train Operated by Multiple Unit Control.

ELECTRIC RAILWAYS

Multiple Unit Control on British Columbia Electric Railway Interurban Cars

The British Columbia Electric Railway Company has recently purchased three new interurban cars, each of which is equipped with four, type 101-B₂, 40 h.p. 500 volt Westinghouse railway motors and "HL" control (See Fig. 1). Type "HL" control, which is a form of multiple unit control, has been eminently successful on some fifty odd roads in the United States. This success is due largely to its construction, simplicity and reliability, which renders it particularly adaptable to city and interurban service. The development of type "HL" control is interesting, since it fills a long felt want for an improved type of railway motor control for city and light interurban-car equipments. This is due largely to the heavy duty which present day car

vidual blow-out coils, etc., in an endeavor to effect reliable operation and to eliminate the annoyance to passengers brought on by controller burn-outs, etc., which may occur except where the most vigilant attention is given to inspection, maintenance, and operation.

A careful study of the requirements and conditions under which controllers are operated, led to the conclusion that the ideal solution of the control problem would lie

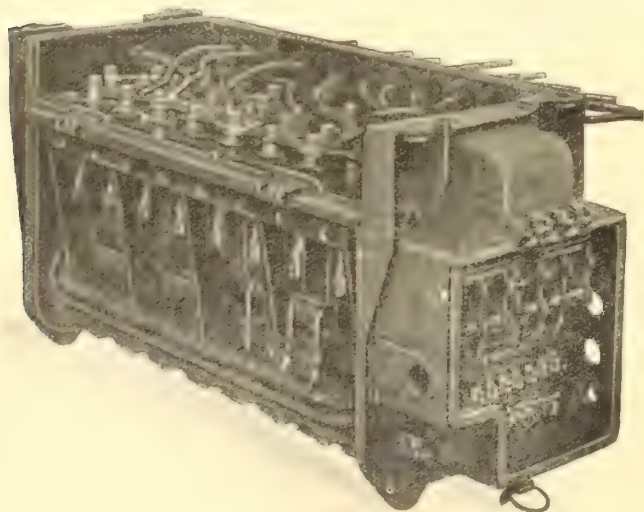


Fig. 2 Rear View, Unit Switch Group—cover removed.

weights and speeds, as well as higher voltages, are imposing on platform controllers, makes serious burnouts not only possible, but probable, unless great care is observed and intelligent adjustment of contacts and parts made at frequent intervals.

The limitations of the standard type of platform controllers have been recognized and a number of devices have been introduced, such as contactors, auto-motoneers, indi-

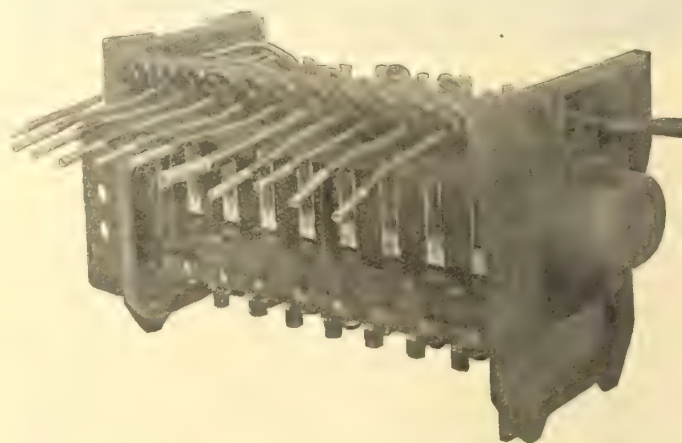


Fig. 3. Front View Unit Switch Group cover removed.

in the entire abandonment of the platform hand controllers and in the employment of power controllers. While the electro-pneumatic contactor or line switch was a step in the right direction, it only partially accomplished the desired result. Its development suggested the question "why not dispose of all heavy current carrying parts as well as circuit-breakers, beneath the car, by means of several unit switches (similar to those employed for contactor equipments) mounted in a common frame and operated with a small current by means of a compact master controller on the platform and carrying no heavy current." Thus type "HL" control was evolved, embodying the characteristics last outlined.

Type "HL" (signifying hand-operated line voltage) is designed for operating motor cars either in trains or as individual units. Fundamentally, the system employed on these cars, comprises a series of eight electro-pneumatically-operated unit switches, mounted in a common frame, known as the "switch group" (Figs. 2 and 3) beneath each

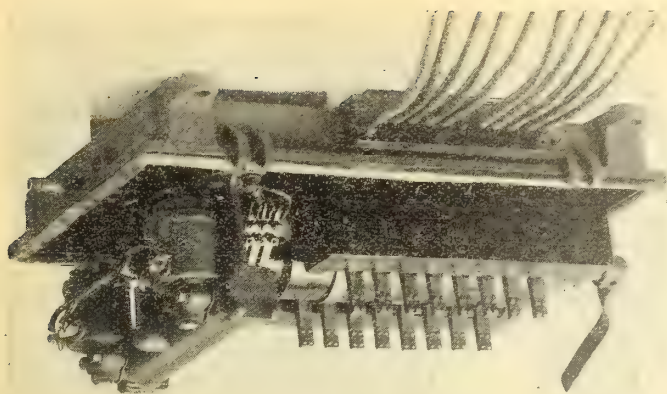


Fig. 4. Pneumatically Operated Reverser

motor car. Each unit switch is equipped with suitable contacts for carrying the motor current and powerful effective magnetic blow-out coils. Small master controllers (Fig. 5) on the car platforms are used to admit low-voltage current to the magnet coils of the unit-switch magnet valves. These magnet coils, in turn, regulate, by means of operating valves, the admission and release of compressed air in the cylinders of switch group and likewise in reverser (Fig. 4). The reverser consists of a revolving drum with contacts and actuated by means of two valve-magnets. The pressure of the air acting on pistons connected to the switches, closes them with great rapidity and force. A strong spring renders positive the release of the switches when the air is released, or exhausted, by the magnet-valves.

The details of the switch mechanism and the magnet valve with pneumatic cylinder for operating the switch are shown in Fig. 6. The unit-switch on one end of switch-group known as the "line switch" performs the functions of a line switch or main circuit breaker. It is provided with an overload trip arranged for re-setting electrically from the car platform. In this way it is possible to re-set

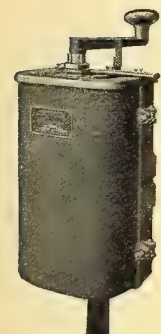


Fig. 5. Master Controller

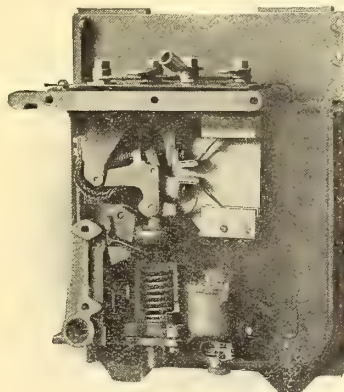


Fig. 6. Sectional View of Unit Switch

the overload trip on all cars of a multiple unit train from any platform. Fig. 3 shows the front view of the switch group with covers removed, also the location of the overload trip mechanism.

The master controllers are similar in general development and simplicity to the ordinary drum type controllers, but are smaller and require less space. The position of the notches are indicated on the controller cover and a compact star wheel mechanism inside of case insures proper movement of drum, and precludes chance of false operation.

There are two distinct circuits on each car, usually known as the control circuit and the main, or motor circuit. Both take currents from the trolley. The schematic layout of the motor and control connections for quadruple equipment of 75 h.p. motor, or less, is shown in Fig. 7. The path of current in the control circuit is from the trolley through control fuse and switch to the master controller. When either of the master controllers is operated, current passes through the proper wires of the multi-conductor cables to junction box, control resistor, switch group and reverser. If the car is coupled in a train, current passes

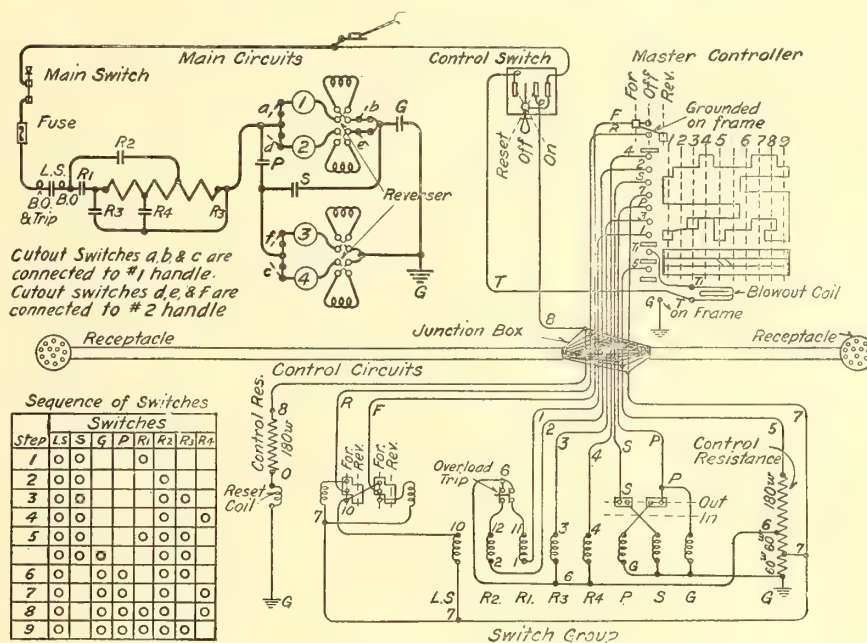


Fig. 7. Diagram of Connections, HL Control

from the multi-conductor cable through the junction box, and receptacles (Fig. 8) and by means of train line jumper (Fig. 9) to the second car where connection is made through a multi-conductor cable to a junction box, control resistor, switch group and reverser on this car, and so on through the remaining cars of train.

The path of current in the main or motor circuit is from trolley to main switch, fuse box and switch group. As either of the master controllers is operated the switches are closed in proper sequence. The connections between grid resistors, motors, reverser and ground are so arranged that a pair of motors may readily be cut out at the end of the switch group without affecting the series-parallel operation. See Fig. 2 rear view of switch group showing motor cutout.

Air for operation of the controller is taken from the main reservoirs. The standard piping connections (Fig. 10) show the path of the air from the reservoirs of the brake system through the cutout cock, O.B. strainer, reducing and check valves to the equalizing reservoir and then to the reverser and switch group. When the pressure in the reservoirs of the brake system does not exceed 70 pounds, the reducing valve is omitted. This arrangement provides for a constant pressure of clean, dry air for the operation of the switch group and reverser.

When motor equipments to be controlled exceed 300 h.p. capacity a two-switch line switch is added to the



Fig. 8. Train Line Receptacle



Fig. 9. Train Line Jumper

equipment furnished on these cars and performs the function of an automatic circuit breaker.

An extra feature is sometimes added to "HL" control equipments—when it is desirable that current collectors on certain of the cars be allowed at times to remain idle—by installing a bus line connection between cars. In the winter season this feature is of value in rendering a continuous flow of current to all motors of train. The supply collectors often become coated with sleet and ice, but the trolley on the first car cleans the wire for the collectors on the rear cars. The bus line receptacles and jumper resemble in construction those used for the train line. They are arranged so that the single conductor has capacity sufficient to carry the total current imposed.

Thus it may be seen that the control used on the British Columbia Electric Railway cars is an equipment which

Large Locomotive for Guelph Radial

The Guelph Radial Railway Co., Guelph, Ont., has recently purchased a 27-ton Baldwin-Westinghouse direct-current locomotive. The cab, trucks and all mechanical parts were built by the Baldwin Locomotive Works, and the electrical equipment, including motors and control, was furnished by the Canadian Westinghouse Co., Limited, of Hamilton, Ont., after the design of the Westinghouse Electric & Manufacturing Company of East Pittsburg, Pa.

This locomotive is compactly built and may be used for freight and switching service. Interurban and city railways are using locomotives like this one, and larger, for various kinds of service, for a road's earning capacity can be materially increased by using locomotives to haul freight during the night or idle hours, thus improving the load factor. Many city roads also use similar locomotives for hauling construction material and refuse to dumping grounds.

The Guelph Radial Railway locomotive is ruggedly built. The frame is of channel iron construction, and the cab is substantially built of clear ash fitted together with joint bolts and corner plates. The trucks are of the standard Baldwin electric M. C. B. equalizer-bar type with chilled cast iron wheels.

The electrical equipment consists of four type No. 101-B-2, 40 h.p., 500 volt Westinghouse railway motors and K-28-B control. It is also equipped with Westinghouse automatic and straight air brakes with outside equalizing driver brakes. The principal dimensions are: Length over end sills 23 ft.; width over all 8 ft.; truck centers 12 ft.; rigid wheel base 6 ft.; total wheel base 18 ft.; wheel diameter 33 inches.

The hauling capacity of this locomotive is given below, cars averaging 45 tons, with load, in weight. Average speed 10.75 miles per hour at 500 volts. On a fairly level and straight

road the load to be handled is determined by the maximum grade.—Straight level road, 17 cars; maximum grade of $\frac{1}{2}$ per cent., 7 cars; of 1 per cent., 4 cars; of 2 per cent., 2 cars.

The figures given for "straight level road" show the load which may be handled in switching service. The values given under "maximum grade" are safe when the grade requires a pull of but five or ten minutes duration,

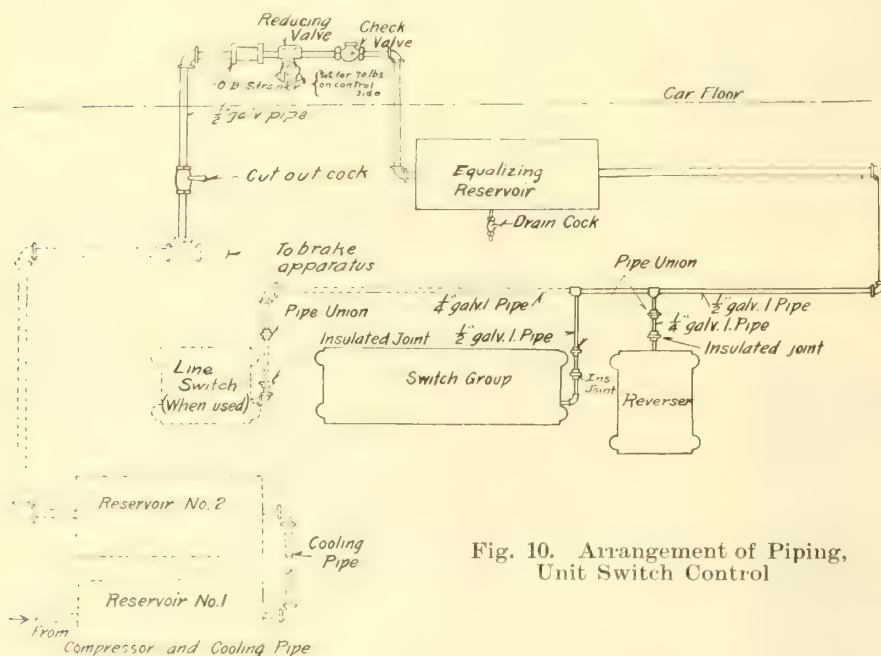


Fig. 10. Arrangement of Piping, Unit Switch Control

permits placing all main circuit apparatus beneath the car floor and provides positive satisfactory operation of the unit switches over the entire operating range of line voltage. At the same time the control is extremely simple, reliable and inexpensive to operate.

This equipment has been supplied and installed by the Canadian Westinghouse Company who have now been manufacturing it at their Hamilton works for the past two or three years.



27-ton Locomotive for Guelph Radial

In any particular case, the number of cars that can be handled may be greater or less than the values above tabulated, depending upon the profile, curves and operating conditions.

Added 29 Miles During 1911

During 1911 the B. C. Electric Railway Company laid 29 miles of new trackage, re-constructed permanent tracks on account of paved streets to the extent of 11 miles, and laid $2\frac{1}{2}$ miles of new trackage during the past twelve months. During the same time the company's orders for rolling stock included 58 passenger cars, 25 box cars, four electric locomotives, and one steam locomotive. As showing the inability of the Canadian car companies to cope with the orders offered, the B. C. E. R. recently endeavored to place an order for fifty passenger cars to be delivered immediately. The best results obtained was the promise that the first car would be delivered about the middle of May, and thereafter at the rate of one car per week. This would mean that the full order of fifty cars would not be completed until May, 1913. Under the circumstances, the company placed its order with a factory in the United States, entailing an additional cost of nearly \$1,000 for each car, to satisfy the growing demand for increased service.

Will Operate at 1200 Volts d.c.

The Westinghouse Electric & Manufacturing Co. has received an order for the complete equipment of three rotary converter sub-stations and one transformer sub-station on the Kansas City, Clay County & St. Joseph Railway Co. The transformer junction station will contain three 750 kv.a., 25 cycle, 6600-33000 volts, oil insulated, self-cooled transformers complete with controlling switchboard and instruments. Each converter sub-station contains six 185 kv.a., 25 cycle, oil insulated, self-cooled transformers, 33000/1200 volts, and two 500 kw., 25 cycle, 1200 volts direct current rotary converters, necessary switchboards, control apparatus, etc. This road represents a total operating mileage of about eighty miles.

Tramway in Okanagan Valley

The Couteau Power Company's charter, acquired by the C. N. R. last year, will be utilized at once and a tramway will be constructed in the spring through the Lumby, White Valley and Goldstream districts, to Vernon, B. C., ultimately connecting up all the towns in the Okanagan. The company will give farmers and fruit-growers all along the route easy and cheap transportation facilities, and will also furnish cheap power for electric light and industrial purposes.

Preston Co. will Supply Lethbridge

The Preston Car & Coach Co. have just received an order from the city of Lethbridge, Alta., for ten electric cars, five 21 ft. car bodies, p.a.y.e. type, mounted on Taylor single trucks, and five 28 ft. car bodies, p.a.y.e. type, mounted on Brill 27G-1 double trucks. Another order from the Toronto & York Radial Ry. calls for five 31 ft. car bodies, double end, p.a.y.e. and two express car bodies. These are for service on the Metropolitan division.

Railway Notes

It is rumored the Western Canada Power Company intends to establish tramway connections on the north side of the Fraser River.

An extension of 4 years is being asked of the Ontario Government by the Dunnville, Wellandport and Beamsville electric railway company to complete their road.

Out of 29 bills relating to electric traction which are to be introduced at the next session of the British Parliament no fewer than 12 seek authority for the running of trackless electric cars.

The Calgary Street Railway, owned by the city, in addition to paying interest on its investment, sinking fund, taxes and other charges, made a profit over everything of \$125,000 during the past year.

The Berlin Light Commissioners propose purchasing two 45 foot double truck p.a.y.e. cars at once. This will enable them to inaugurate a regular 10-minute service between Berlin and Waterloo. Mr. V. S. McIntyre is superintendent of the street railway system.

Application has been made to the Ontario Legislature by the Kawartha Transportation Co. for power to build an electric railway in the city of Peterborough and surrounding municipalities. The idea apparently is to supply the summer resorts on the Kawartha Lakes with better transportation facilities.

Providing the Montreal & Southern Counties Railway can obtain free rights of way, the company will extend its lines in the spring from Longueuil to Boucherville. Nearly all the proprietors have consented to give these rights. The new branch to Richelieu will be ready on July 1st next, and the company is also being petitioned to extend the line from Richelieu to Sorel.

An action was recently brought by Mr. A. N. Warfield, of London, Ont., against W. A. and N. R. Bugg, of the People's Railway Company. Mr. Warfield explained that an agreement had been entered into between himself and the Bugg Bros. by which they were to divide \$100,000 of stock in the People's Railway Co. among themselves and that in addition he was to receive \$200 a month salary. Suit was for some \$3,000 due him on the latter account. Chief Justice Falconbridge dismissed the action with the remark that the agreement was one of manifest impropriety and of doubtful legality.

Rubber Covered Wire

At a recent meeting of the Canadian Wire Manufacturers with the chief electrical inspectors of the Canadian Fire Underwriters' Association, Mr. James Bennett for Quebec, and Mr. H. F. Strickland for Ontario, it was decided to adopt the 1911 National Electric code with reference to rubber covered wire. The decision will go into operation January 1st, 1913.

CANADIAN TELEPHONES

The Dominion Railway Board and the Proposed "Bell" Agreement

Dr. Doan, the president of the Canadian Independent Telephone Association, has addressed the following letter to the various telephone companies throughout Ontario referring to the recent draft agreement submitted by the Bell Telephone Company to the Board of Railway Commissioners for their approval:

"I beg to inform you that, at the request of the Executive, the Board of Railway Commissioners for Canada has postponed consideration of the application of the Bell Telephone Company for the approval of a standard form of connecting agreement, in order to give the owners of local and rural systems an opportunity of presenting their views before the Board at the Toronto sittings, next month.

As this is a matter of vital importance to you, I would urge upon you the desirability of uniting with this Association in its efforts to secure such amendments to this proposed agreement, before its approval by the Board, as are essential to the interests of all systems operating in Ontario.

In the opinion of the Executive, the objectionable features of this proposed agreement are as follows:—

1. It confines your operations within a limited area, thereby preventing the extension of service to those who may desire to become subscribers in adjacent territory, contrary to the provisions of Section 12 of The Ontario Telephone Act, 1910.
2. It compels you to interchange service with all systems connecting with the Bell Telephone Company, but does not allow systems connecting with you the same privilege.
3. It requires the payment of a yearly rental of Two Dollars per one quarter mile or fraction thereof, for each circuit, within the Exchange limits of the Bell Telephone Company, at all points where connection is made.
4. It makes compulsory the furnishing of detailed information in regard to your business, which no outside person or company is entitled to.
5. It requires you to purchase 75 copies of each issue of Bell directories for every hundred of your subscribers, notwithstanding that you may not be able to sell them to your subscribers.
6. It requires you to pay five cents per call for connection with other systems connecting with the Bell company, but does not give you the right to make any charge for calls coming in from the subscribers to those systems.
7. It enables the Bell company to cancel your connection should you get into financial difficulties, thereby rendering your system valueless and making it almost impossible for you to re-arrange your business affairs.
8. It enables the Bell company to cancel your connection should you sell or transfer your system, which means that you cannot dispose of your business interests without the consent of the Bell company.

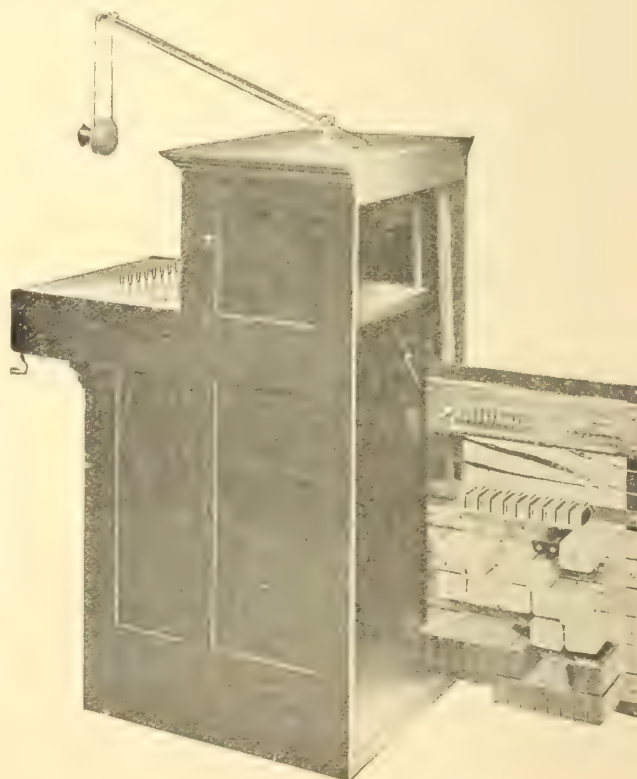
It is proposed to hold a meeting of those interested, in Toronto, on the 26th instant, to consider what action should be taken. The Executive hopes that you will assist it in its efforts to prevent the approval of an unsatisfactory form of agreement, by sending a representative to this meeting. Upon your notifying the Secretary that you will be represented at this meeting, you will be advised of the time and place."

Detroit Favors Reasonable Rates

Detroit may use the measured service plan in connection with their telephones. Corporation Counsel Hally, of that city has outlined to council a scheme of telephone charges which it is hoped the city will be able to force the telephone companies to put into operation. In this plan it is suggested that all flat rates be abolished and also all distinction between business and private telephones. For each telephone whether in a private or a business house a rate of \$3.50 a month is suggested with 200 free outgoing messages per month. Extra calls over this number must be paid for at the rate of 1c. per call. Both 2-party and 4-party lines are in service in Detroit and the proposed rate for these is \$1.80 a month allowing 100 messages for a 2-party line and \$1 a month with 50 messages for a 4-party line. Extra calls 1 cent each. No conversation can last longer than three minutes. In Detroit there are said to be about 60,000 telephones with an average number of daily calls of 9 each. Mr. Hally draws the conclusion that the present rates are evidently discriminating in favor of business, as opposed to residence telephones and believes that the suggested rates will prove much more equitable.

Superior P. B. X. Switchboard

The Stromberg-Carlson Telephone Manufacturing Co., have just issued a description of their new type of switchboard which we illustrate herewith. A particular feature of this equipment is its accessibility. In the illustration the



rear of the switchboard is shown and it is seen that the installer or inspector can get at everything inside the cabinet without difficulty. If this switchboard is placed with its back to the wall a similar door allows access from the front. These switchboards are designed for common battery private branch exchanges to operate at either 40 or 20

volts as required. They are carried in stock complete in 10, 20 or 30 lines capacity. All boards are wired for the ultimate capacity, 30 lines, so that additional apparatus can be quickly installed.

British Government Takes Over Telephones

On Jan. 1 all the privately owned and operated telephone lines in Great Britain were taken over by the Government under an agreement made some years ago. It is said that about \$80,000,000 and 18,000 employees are involved in the change. The government will now have under its control about 134 million miles and between 700,000 and 800,000 subscribers. The Government Telephone System in England has never been a paying proposition for the reason that, in part, it has been made subsidiary to the telegraph system. If the plan of management continues the same as formerly, this new acquisition would seem to open the way for tremendous deficits in the government telephone department.

Highly Pleased with Telephone Despatching

Mr. W. I. Camp, electrical engineer of the C.P.R. expresses himself as highly satisfied with the despatching of trains by telephone, and is convinced of the superiority of the new method over the old one of despatching by telegraph. Next year, Mr. Camp says, the C.P.R. will add at least 1,000 miles of new circuits. Most of this new mileage will be on western lines, as the main lines of the eastern divisions are now practically all using the telephone system. Already 4,000 miles of circuits have been installed on the C. P. R., and when next year's additions have been made, the C. P. R. will just about lead the world in that respect.

New Central Office Equipment at Forest, Ont

The People's Telephone Company of Forest, Ontario, have placed an order with the Stromberg-Carlson Telephone Manufacturing Company, of Toronto, for a second section of switchboard, containing facilities for handling 150 additional town and suburban subscribers.

The growth of this company in the five years since their organization has been remarkable. Their directory contains at present about 400 names and new service contracts are rapidly coming in. This is a good example of what progressive and well managed independent telephone companies can do in Ontario.

Telephone Notes

An addition is being made to the B. C. Telephone Company's exchange at Nanaimo, at a cost of \$7,000.

In spite of the increased rates in Winnipeg it is said that the department had 75 orders on hand with which to begin the New Year.

The Manitoba Government has appointed a commission to enquire into the telephone situation in that province. The commission comprises Judge Locke, chairman; G. R. Crowe and R. L. Barry.

The municipality of Brenda has voted to sell out their telephone system to the Manitoba Government. The government assumes the payment of the debentures covering the cost of the system and pays \$3,000 cash.

On Jan. 1st the Eastern Telephone Co., operating in the neighborhood of North Sydney, N.S., was taken over by the Maritime Telegraph and Telephone Co. A new switchboard is being installed by the Northern Electric

and Manufacturing Co. In future all bills will be collected monthly at the end of the month instead of in advance as is the usual custom.

It is the intention of the British Columbia Telephone Co., in the near future to build a new exchange which will be known as the Highland exchange. A cable will also be laid connecting Vancouver with North Vancouver.

Premier Roblin recently announced the intention of the Manitoba Government to appoint a Public Utilities Commission which will have charge of all government owned utilities including among others the telephone system.

A new exchange building costing \$45,000 is being erected for the British Columbia Telephone Company at Turner street, Vancouver. The structure is four storeys, 43 x 60, steel and concrete, with brick facings, and will cost over \$200,000.

The executive of the Ontario Municipal Association will deal at their next meeting with the question of application for legislation to give municipalities the power to force private companies to place their electric distribution wires under-ground.

The residence rate for telephones in Winnipeg which on the measured service plan was first announced as \$1.50 per month allowing 30 outgoing calls with 2c. per call in excess of this number has been modified to allow a customer 40 calls per month without extra charge.

At a meeting of the Preston Farmers' Club held recently at the Maple Grove school house, Waterloo township, the question of the installation of a rural telephone system covering the territory situated between Breslau, Berlin, Preston, Hespeler and Guelph road was favorably considered.

The Okanagan Telephone Company, with managing offices at Vernon, Armstrong, Enderby, Salmon Arm, Long Lake, etc., has acquired the system operated until recently by the Lakeshore Telephone Company, with head office at Summerland, B. C. It is the intention of the purchasing concern to extend the system up and down throughout the Okanagan Valley, under the management of Mr. Geo. H. Dobie, of Vernon.

The British Columbia Telephone Company has been awaiting for two years the consent of the Public Works Department to lay a new fifty-pair cable across the harbor to handle the North Vancouver business. The cost of the new service is placed at \$30,000. The new Highland exchange, which will serve Grandview and Hastings districts, will call for an expenditure of \$200,000. The contract for this building will be awarded in the near future.

Mr. Allen Purvis, superintendent of interurban lines of the B. C. E. R. Company system, has resigned his office. His place has been taken by Mr. G. H. Franklin, formerly local manager of the company's Lulu Island interurban division, as acting superintendent of interurban lines. Mr. Franklin's former duties have been assumed by Mr. E. Sterling, formerly trainmaster on the company's interurban lines at New Westminster. The management of the company has also accepted the resignation of Mr. W. H. Elson, local manager of the New Westminster lines, but no appointment has yet been made for this post.

Questions and Answers

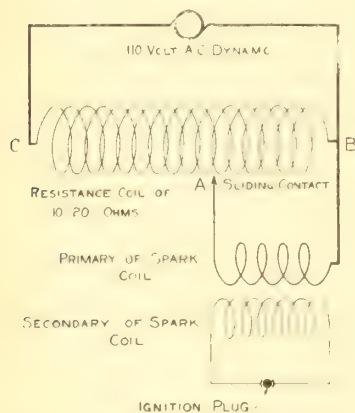
GENERAL RULES TO BE OBSERVED BY CORRESPONDENTS

1. All enquiries will be answered in the order received, unless special circumstances warrant other action.
2. Questions to be answered in any specified issue, should be in our hands by the close of the month preceding publication.
3. Questions should be confined to subjects of general interest. Those pertaining to the relative value of different makes of apparatus, or which for intelligent treatment, should be placed in the hands of a consulting engineer, cannot be considered in this department.
4. To avoid trouble and unnecessary delay, correspondents should state their questions clearly, so that there can be no possible doubt as to the information required.
5. In all cases the names of our correspondents will be treated confidentially.

Operating Spark-Coil Off 110 Volt Circuit

Q.—Can we use the 110-volt alternating current to start a stationary gasoline engine instead of dry batteries. After the engine is started the ignition is furnished by a magneto.

A.—Yes, the 110-volt alternating current can be used instead of the dry batteries to excite your spark coil, but it will be necessary to take one or two precautions in the use of the higher voltage. You no doubt understand that



the spark coil requires only about eight or ten volts to operate it and perhaps the same number of amperes. The exact value of both the volts and amperes will vary with the size of your coil. So, it will be necessary to insert a resistance in the 110-volt circuit and connect up your coil after some such plan as shown in the accompanying drawing. BC represents a resistance coil of from 10 to 20 ohms, which will allow a current of (say) from 5 to 10 amp. to flow through it. If you can obtain, with an ammeter or otherwise, the approximate strength of current the coil is using from the batteries you will be able to calculate the amount of resistance required in BC that you may get about the same current. In the figure, A represents a sliding contact. The potential fall between the points A and B will need to be adjusted to about 8 or 10 volts, that is, the number of coils between A and B will be about 10 or 12 per cent. of the total number of coils in BC.

You will notice also that the interrupter has to be cut out of your circuit as the alternating current passing through the primary of the spark coil induces the necessary current in the secondary by its own alternations.

A common way to make the resistance AB is in the form of a box containing a number of coils of iron wire connected with binding parts at two such points along the resistance wires that the potential fall between these posts is the amount required. A very satisfactory and much simpler resistance could be made, however, as shown in the drawing, by winding german-silver wire of a fair size around an insulating cylinder. It may appear at first sight that the amount of current lost is great but the length of time this arrangement would be used is so short that the actual consumption is inappreciable.

Solid vs. Laminated Cores

The following letter on this interesting question has been submitted by Mr. Joseph Showalter,—

In the January issue of the Electrical News, under "Questions and Answers," a brief explanation was given for not using solid iron cores in induction motors and watt-hour meters. I beg to submit a few remarks in reference to watt-hour meters which may interest your readers.

In the design of a small single-phase motor to be used as a watt-hour meter, it is necessary to make use of some peculiarities, which would be very objectionable in a motor for generating power. The tendency to create secondary currents in any solid piece of conducting material in the path of the lines of force of the alternating magnetic fields is certainly to be guarded against in power motors. However, in an induction watt meter, these secondary currents under proper regulation are necessary to secure adjustment and accurate operation.

Induction meters having their field cores made up of thin pieces of iron require a closed circuited winding or piece of conducting material placed in such a position as to embrace most or all of the lines of force of the potential field. This secondary circuit must be adjustable in some manner. If it is a coil of a number of turns of wire, it is usually shorted through a variable resistance. If it is a ring or a solid piece of copper or other conducting material, its position is usually adjustable. The purpose of this is to secure a displacement of a shunt field magnetic flux in relation to the flux of the field energized by the series current, of exactly 90 degrees or a quarter of a cycle. It is only when the two fields have this relation that the driving energy imparted to the rotary element of the meter will be directly proportional to the true watts in the circuit.

If properly designed solid field cores are used, sufficient secondary currents are generated within the core itself to effect the desired "quarter-phasing." The exact adjustment can be secured by moving the potential coil toward or from the pole pieces.

A type of meter in very extensive use throughout Canada as well as nearly all other civilized countries, is made with its field core solid. This meter has a higher efficiency than most meters with laminated fields, and its shunt loss is only about one and three-fourths watts in the 100 volt sizes. I refer to the type of meter manufactured by Ferranti, Limited.

Eight Year Topical Index

With the January issue, The Electric Journal is mailing its Eight Year Topical Index. This index, which has become a noteworthy feature in connection with this publication, now covers some 6,500 pages of valuable technical material representing a wide range of articles of engineering interest. These articles, as bound in permanent form in eight volumes, are made readily accessible by the use of the topical method of indexing, as it is necessary only to refer to the index in the latest volume to find references to all articles which have appeared on any desired subject. In general, the article references are classified under four divisions:—"Generation," "Transformation," "Transmission" and "Utilization," these subjects representing a logical arrangement. A key is given on the first page of the Index to indicate the location of each of the various subdivisions. References are given throughout the Index to answers published in The Journal Question Box.

The incorporation of the Lake Francis Telephone Co., Limited, for the purpose of acquiring, constructing, equipping, operating, &c., a telephone system within the municipality of Woodlands, Manitoba, is reported.

Electrical Operations in Canton, China, Carried on by an English Company under Difficulties

An interesting account of electrical operations in Southern China has been received at this office from Mr. S. F. Ricketts, A.M.I.E.E., of Vancouver. Mr. Ricketts spent several years in active electrical management in Canton. We regret that lack of space will not allow us to reproduce the whole, but the following extracts are representative.

"Canton has a population which is variously estimated from two to four millions, but a census has never been taken and owing to the existing conditions of living there is no possibility of making a closer estimate.

"There has always been a desire on the part of the Chinese to exclude the foreigner from everything in China, and it has only been by force of arms and the magnificent efforts of the pioneers that China has come to recognize the importance of foreign methods and industries. There is however still much to be done in the education of the race before they can hope to catch up with the times, but a brighter day is dawning in China, although the anti-foreign feeling will probably always remain as a national characteristic.

"The electric lighting supply was originally attempted by a Chinese company, but on account of bad management it was finally taken over in 1902 by Messrs. Shewan, Tomes & Co., a leading British business house with its head office in Hong Kong and a branch in Canton, who promoted the China Light & Power Co., Ltd., as a British company, to purchase the franchise and the plant. Various attempts were made by them to run the plant as it stood but it gave endless trouble. It is characteristic that the Chinese consumer bore it patiently and that mostly all the grumbling was done by the foreign community, who live on an island by themselves.

"The city streets average about seven to ten feet in width and it was here that we experienced much trouble. Of necessity all mains were carried overhead and the erection of poles was a complicated business. Fortunately very few of the houses and shops were built higher than two storeys so that a thirty-five foot pole usually served the purpose, but often a longer pole was necessary which required special science in manipulating. Owing to the narrowness of the streets and the absence of pavement there are no vehicles, and everything has to be carried by coolies. When a long pole had to be taken around a corner the men had to get upon the house tops, stand the pole up straight and let it down into the other street. The shop signs often had to come down, also the bridges from across the streets on which the watchmen wander about the roofs; but labor is cheap. When a pole was erected it was pushed into the corner between two shops, and often became so much a part of the building that it would have been almost impossible to take it away and leave the house. Often we met with the superstition of the people in these matters and had to rechoose our site in order to keep the peace, although at times this was impossible and we had to argue it out while we went on with the erection. Our one aim was to get the wires high enough over the shops to prevent people hanging their clothes on them, for all washing is dried upon the roof, and it is often possible to walk for a quarter of a mile upon the roof tops when out on inspection and testing work. Every house or shop has an exit on the roof.

"We experienced wire troubles from time to time when large bamboo structures were erected for street theatres or other festivities, often in front of temples and public institutions. On one occasion such a structure had been put up and the men had callously tied all our h. t. wires to-

gether in a bunch, carrying the bamboo structure up around them. When asked to be allowed to cut a hole in the side of the mat-shed, our men were refused and considerable feeling aroused. As the feeder happened to lead to the Viceroy's Yarmun, the writer interviewed the Viceroy's secretary, and after explaining that light could not be supplied that night a party of soldiers were immediately despatched, the sight of which had the desired effect.

"On another occasion we discovered, during the dry season, a small leak to earth on one of the h.t. feeders. Travelling through the city on an inspection, we came to a place where the man had built an additional storey to his shop. The mains had passed directly over the building but he had not advised us of the alteration and had bricked the h.t. mains into the wall.

"The Chinese do not realize what high voltage and dangerous conditions are, consequently we have experienced some bad accidents. In one case men were found beating a poor fellow all over with rubber shoes after he had received a shock, as they had heard that rubber would drive away electricity. Others who have tried to steal live cable have been doubly shocked.

"In time we graded our men into four classes, the scale of wages in Canadian dollars being approximately A, \$9.00; B, \$7.00; C, \$6.00, and D, \$4.00 per month, including lodging only at the station. This scale of pay is good for the ordinary Chinese workman. We undertook the whole of the installation work in the city as we had no electrical contractors around the town and our franchise included a monopoly of this work.

"One morning in August 1908, after the typhoon had been blowing all night, we found the poles along the water front for two miles lying on the ground tangled up with the lines and general refuse. Only those who have experienced the typhoons of the Far East can realize the havoc that can result. The writer has seen iron poles doubled up into all manner of shapes from the results of these typhoons and the loss on this account is always very heavy. The awful lightning storms also require a good deal of protecting against. Alternators have on several occasions been burned out by a discharge which would partly go to earth through an arrester and partly through the machine. Often a line would go completely to earth after a discharge and a spark gap arrester would be found out on the line the inside of which would be a molten mass of metal.

"An amusing incident occurred on the occasion when we first tested a new flame arc lamp. It was erected outside the station and lighted. The unusually brilliant glow of the red flame attracted the attention of a watchman not far distant, who immediately turned out the street fire brigade. Each important street or group of streets has its own hand pump on wheels, which is hauled and worked by coolies living in the shops in the particular streets. All engines go to a fire and the first on the scene are paid extra for their promptness. On this occasion the brigade came rushing out of the narrow street end with the usual accompaniment of noise only to be received by a huge and highly delighted crowd who were enjoying the novel experiment in electric lighting.

"It must be said however, that the Chinese workmen are faithful, efficient and diligent and have the making of a good industrial race if only they can inculcate some of the foreign ideas and manage to imbibe some technical knowledge and foreign initiative. From the financial point of view a Chinese company cannot succeed, for Chinese directors have no sense of their responsibilities when the money they are spending belongs to others."

Industrial Progress and Trade Notes

New Companies

The Canadian Union Electric Company, Limited, has been registered in Montreal. Mr. Allan B. Wearing is named as vice-president and general manager.

Electrical Construction Company, Limited, incorporated with a capital of \$75,000, to buy, sell and deal in light, heat, power or other electrical machinery and supplies.

The Ashawota Power Company Limited, Vancouver, B.C., has been incorporated with a capital of \$10,000 to carry on business as a general light, heat and power company.

Fraser Lake Water and Power Company, Limited, Victoria, B.C., incorporated with a capital of \$25,000, to construct and operate telephone and telegraph systems and carry on a general power business.

The Electrical Construction Co., Limited, Vancouver, B.C., has been incorporated with a capital of \$75,000 to sell and deal in electrical, oil, gas or other motive machinery, &c., for production of light, heat and power.

The Jovite Power and Electric Company, Limited, has been incorporated, with a capital of \$20,000, its powers including hydraulic power rights, the production of electricity and gas for the purposes of the company, and the right to sell the surplus in the counties of Terrebonne and Ottawa. The head office is at Sainte Jovite, P.Q.

The Canadian Hydro-electric Construction Company has been incorporated with a capital stock of \$50,000 for the purpose of carrying on the business of contractors and engineers in various public and private undertakings including the development and operation of water powers, telephones and electric railways. The head office of the company is in Toronto.

Unilets for Open Work

The Appleton Electric Company, of Chicago, are now manufacturing very neat Unilets for open work wiring. These Unilets are made of No. 14 gauge stamped steel, and furnished with porcelain covers for drop cords, etc. This company also manufacture a very useful line of Switch Unilets of stamped steel for one and two gang switches. These fittings are light in weight, very strong, and at the same time neat in appearance.

Packard Extensions

The Packard Electric Company, Limited, are making extensions in their transformer and meter departments which will put them in a position to take care of the greatly increased demand for their apparatus. The factory has been working up to the limit of capacity during the past year, and yet has been unable to keep pace with orders. With the extensions now under way it is hoped that the output will be sufficient to supply everybody during 1912.

Increasing Capital Stock

The Canadian Carbon Co., Ltd. is, we understand, increasing its capital stock to \$100,000. The additional funds will be used for the expansion of the business along various

new lines as well as to cope more successfully with business which has been already established. For an enterprise that has been in existence for such a comparatively short time as the Canadian Carbon Co., this marked progress must be very gratifying to its president, Mr. Alfred Landau, and his associates.

Allis-Chalmers Affairs

The recent announcement of a receivership for the Allis-Chalmers Company, of Milwaukee, was evidently premature and probably quite inaccurate. It is understood now that the bondholders' and stock holders' committees are working in harmony with the company, with a view to conserving the property and the outlook is that the company will be placed on a sound financial basis. No change is probable in the manufacturing policy of the Allis-Chalmers Company. It may be well to point out, too, that the Allis-Chalmers-Bullock Company, of Montreal, is an entirely separate and distinct organization, and even in the event of the original reports having been correct the Canadian Company would not have been affected in any way.

Another British Firm forms Canadian Company

A Canadian company has been formed to take over the business, on this continent, of Chamberlain & Hookham, Limited, meter and time-switches manufacturers, of Birmingham, England. During the past summer Mr. Ernest E. Sharp, a director of the parent company, has covered the Canadian field extensively and reached the conclusion that the time was ripe for the formation of a Canadian company. The position of Canadian manager has been filled by the appointment of Mr. Stanley L. B. Lines, who will be permanent resident director, with head office and stores in Toronto. We are informed that the business of the Chamberlain & Hookham Company has increased during the past year by approximately fifty per cent. This is all the more remarkable in a company which has been doing a progressive business for over twenty-five years.

Roper, Clarke & Co., Ltd.

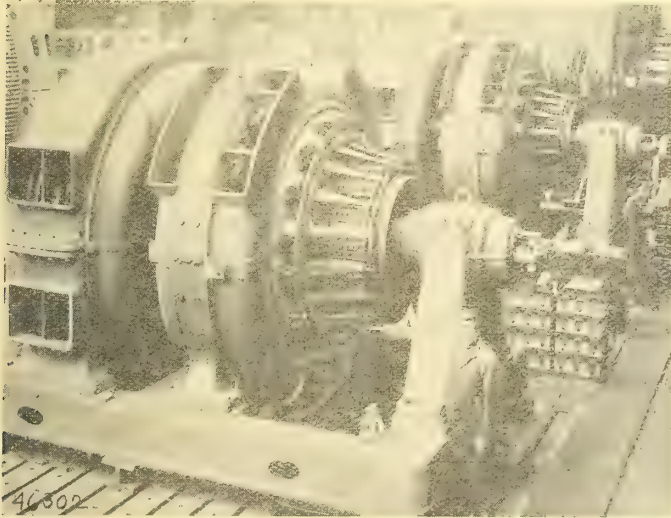
A new company under the name Roper, Clarke & Co., Ltd., manufacturers' agents, has been formed to handle electrical apparatus and supplies, machine tools, &c. The head office of the company is in Montreal, 141 St. Peter street, where operations were commenced on January 1.

The senior member of the firm is Mr. W. P. Roper, late Ottawa manager of the Canadian General Electric Company's branch. Mr. Roper has been with the C.G.E. going on for 18 years during which time he has held a number of responsible positions. These include 3 years in Montreal, where he was assistant manager of the branch there and another 3 years as manager at Ottawa. In addition, Mr. Roper was general superintendent for one year of the Charlottetown Light and Power Co., and also spent a year and a half on the construction work of the West Kootenay Power & Light Co. His very general and thorough experience will prove of great value to the new firm of which he now assumes the head.

The Minnesota Electric Company, Minneapolis, announce that they have placed the exclusive selling agency in Canada for the Chapman Lightning Arrester with the Northern Electric & Manufacturing Company.

Trend Towards Larger Units

An example of the present tendency towards the building of large machines is given in the view shown herewith, which was taken in one of the main aisles in the Westinghouse East Pittsburg Works. In the foreground are two motor generator sets, each of 1500 kw. capacity, consisting of a 2250 h.p., 12000 volt, 3-phase, 60-cycle, synchronous motor direct connected to and mounted on a common iron base with a 1500 kw. 250 volt direct current generator. The openings shown in the frame are for the attachment of conduits which will conduct the heat from the machines



Large Westinghouse Units on Order

to the outside of the building. This scheme of enclosure and ducts also will assist in conducting the noise away from the building.

To the left and rear of these sets is a 4000 kw. rotary converter capable of handling a maximum swing of 8000 kilowatts. This machine is equipped with commutating poles, and is believed to be the largest rotary converter ever built.

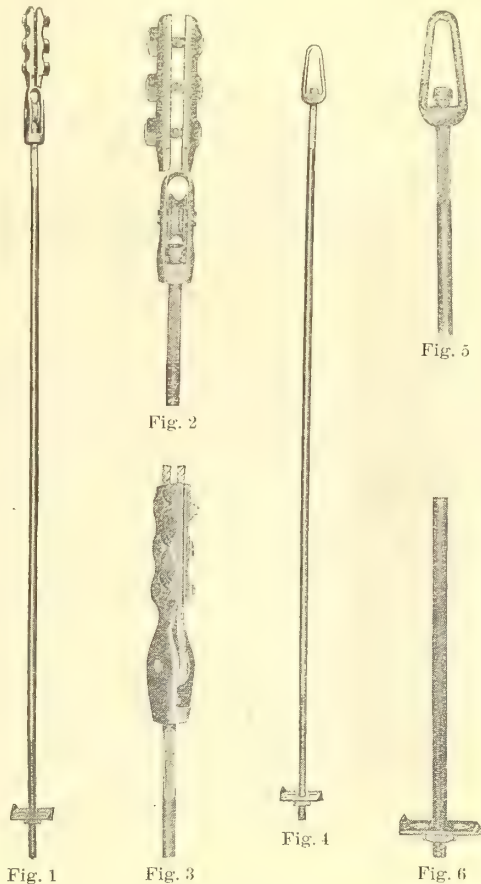
To the right and rear of the motor generator sets are some 3000 kw. rotary converters. In the immediate vicinity, but obscured from the view by the other machines in this aisle, are two 12,500 kv.a. 6600 volt, 50 cycle, 300 r.p.m. vertical waterwheel generators, being built for the Rio de Janeiro Tram, Light & Power Company.

An Adjustable Anchor Rod

An adjustable anchor rod known as the Adjustarod, was recently placed on the market by the Crouse-Hinds Company of Canada which greatly simplifies and facilitates the installation of "dead man" anchors. The new invention is a union of all metal parts that belong to an anchor of this character and also has turnbuckle properties designed to permit regulation of wire tension. The Adjustarod is made in two types—A (Figs. 1, 2, 3, and 6), and B (Figs. 4, 5 and 6). Type A consists of clamp, pulley, swivel, rod, washer and base-nut. Type B has an eye to receive the guy wire, a swivel, rod, washer and base-nut. Each type, complete, is purchased as a unit and handled as such up to the actual work of installing. Thus, buying is simplified and there is no danger of any part being missing at the last moment.

To start at the top of type A, and read it downward, the clamp, Fig. 2, is of malleable iron, cast in two parts, the inner surface of each being grooved to receive the guy wire. Three seven-sixteenth-inch wrought iron bolts, with heavy square heads and nuts, bind the two parts of the clamp against the guy wire. Below the clamp is the pulley,

the housing of which is cast with one piece of the clamp. The sheave, or pulley wheel, is a grey iron casting, grooved to take guy wire up to the largest standard size. Fig. 3 shows guy wire clamped in. Cold rolled steel is used for the sheave pin, both ends of which are upset after mounting, thus holding the sheave permanently in position. The lower end of the pulley housing constitutes the swivel ring. Through this ring projects the upper end of the rod, topped by a substantial upset head. The rod is of wrought iron and round, except for a few inches below the swivel ring, where square sides are provided to give a gripping surface for a wrench. On the lower end of the rod are twelve inches of threading to receive a heavy base-nut. A large washer, of No. 10 gauge sheet steel, slips on the rod immediately above the base-nut (Fig. 6). This washer has bent-up corners that sink into the "dead man." Two down-turned ears, on opposite sides of the center hole, are stamped from the washer and provide a channel into which the base-nut fits snugly. The ears slightly overlap the nut and hold it tight against the washer. Nut and washer, together with the threaded rod, make up a turnbuckle of great strength. The rod alone is five feet long, and the over-all measurement is five feet and eleven inches.



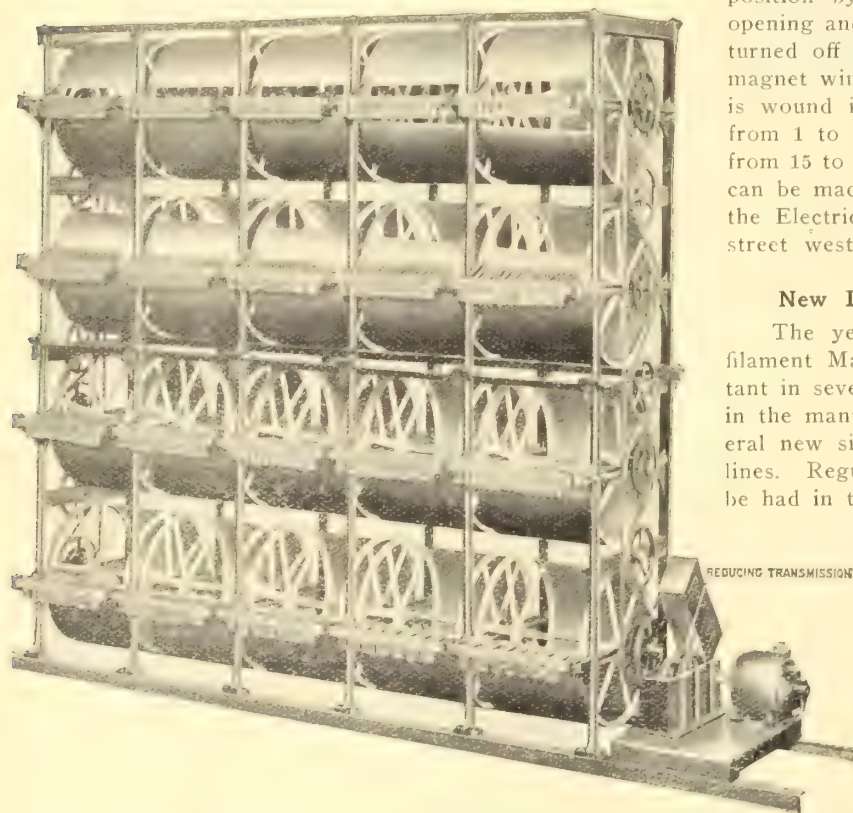
In type B, the combined eye and swivel ring is of malleable cast iron. All other parts are identical with those of type A. The over-all length is five feet and four inches. This type seemingly is assured of much popularity because of its manifest advantages over the ordinary anchor rod, although the clamp and pulley device of the A type is certainly an additional advantage. When this latter type is used the guy wire cannot bind but runs smoothly through the pulley. The clamp, being cast with the pulley housing, is always in position to receive the wire and hence the man's hands are free to tighten the nuts. The pulley, however, does away with that slipping, time-consuming, temper-provoking thing—a thimble. Each blow required to

knock a thimble back in position carries the danger of nicking and weakening the guy wire. The elimination of this risk is a valuable consideration.

Flashing Equipment of Unusual Proportions

Talbot's Hippodrome, a large and handsome new theatre in St. Louis, is made conspicuous at night by a facade of lighting, of which the effect is similar to that which would be reproduced by an artist who made an outline sketch of the principal architectural features of the front of the building. This flashing of the spectacular outline lighting on the building front is accomplished by means of a lamp flasher of unusual interest, which is illustrated herewith. This mechanism, which is 6 ft. high and 8 ft. long, is one of the largest in service at the present time and has 232 switches of various carrying capacities, operated on 18-in. drums. The arrangement is for 191 changes, and the total number of lamps controlled by this machine is about 8000. The lighting load controlled is about 4000 amp. at 10 volts, low voltage Tungsten lamps being used. A 1/6 h.p., 110 volt direct-current motor drives the switching mechanism through a set of reducing gears, which reduce the speed of the armature shaft in the ratio of 2500 to 1.

Fifty seconds is consumed in the operation of flashing the lamps on the entire theatre front. The flashing begins by first throwing into circuit the semi-circular cornice over

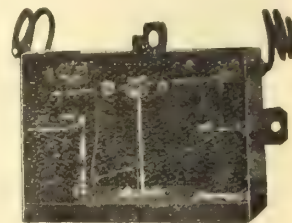


the middle portion of the facade. The lamps come on one at a time in a similar manner to that observed in the script-writing effects often seen in electric signs. Other rows of lamps come on in the same manner, and light up in regular order various designs of the architectural ornamentation. The cornices and outlines on each side of the central portion next come into view, then the intervening sections and finally the window outlines, one at a time, until all the original features of the front of the building stand out in lines of light. As stated before, the effect is as though an artist had sketched in the principal outlines of the facade, and the appearance is novel and striking. When the entire building front is outlined, the lamps burn for seventy

seconds and then are extinguished in the order in which they were lighted. The Reynolds Electric Flasher Manufacturing Company manufactured and installed the apparatus.

The Sheldrick Maximum Demand Controller

The object of the Sheldrick controller, here illustrated, is to prevent consumers of electricity who pay a flat rate from installing more lights than they have contracted for. It weighs 3½ lbs., and consists of an evenly balanced scale bar with delicate bearings. A solenoid magnet is attached at one end of the bar, and an inverted U tube which dips into two heavy iron bottles containing mercury at the other end. The U tube closes the circuit between the two iron bottles and is kept amalgamated by the mercury, insuring good electrical contacts. A small weight on the bar when set close to the upright post, just balances. It is provided with a set screw, and by sliding back and forth can be instantly set as required. When the load exceeds the demand the iron core in the magnet is drawn down, and the U-shaped rod connecting the bottles is drawn up until the circuit is opened; it instantly falls back into the mercury in normal position by its own weight, however, and continues the opening and closing of the circuit until the excess has been turned off by the consumer. The range is limited by the magnet winding. To cover all practical ranges the magnet is wound in three sizes; low, which can be adjusted for from 1 to 7 lights; medium, from 5 to 20 lights and high, from 15 to 50 lights of ordinary 16 c.p. lamps; higher ranges can be made to order. This controller is manufactured by the Electric Specialties Manufacturing Company, 157 Craig street west, Montreal.



New Incandescent Lamps Recently Standardized

The year 1911 marks the advent of the drawn wire filament Mazda lamp. This development, the most important in several years, has opened up new possibilities, both in the manufacture and use of high efficiency lamps. Several new sizes of lamps have been added to the standard lines. Regular Mazda lamps for 100-130 volts are now to be had in the 15 and 20-watt sizes in straight sided bulbs, and 15-watt sizes in 2-5/8 in. round bulbs. For voltages between 200 and 260 a 25-watt Mazda lamp is now available.

A complete line of Gem and Mazda lamps for street railway service has just been brought out. This includes 35 and 54 watt Gem lamps for burning five in series on 500 to 650 volts. For gauge light service Mazda lamps of the sign type are now made in 2½, 3½ and 5-watt sizes, so selected for current as to operate in series with regular arc lamps. The use of regular Mazda lamps in street cars has been proven entirely practicable by numerous service tests under various conditions. Most of the above lamps are derived from regular multiple lamps by operating them at reduced efficiency and power consumption.

To the train lighting list has been added a 10-watt Mazda lamp which has already been used to a large extent as a berth lamp. Among the regular Gem lamps is now listed the 30-watt size in a 2½ inch bulb. These will supply the demand for small incandescent lamps of about 8 or 10 c.p. or replace the similar carbon lamp.

Current News and Notes

Aylmer, Ont.

The South Malahide Telephone Company, J. Bradley, Aylmer, secretary, is in the market for cable, poles and guy wires required for the placing of individual and party lines in cables.

Brampton, Ont.

The by-law to purchase Brampton Electric Light franchise carried.

Brantford, Ont.

In his inaugural address Mayor Hartman urged that a by-law be submitted as soon as possible asking power to connect up with the hydro-electric system.

Berlin, Ont.

By-law to spend \$7,400 on street railway extensions carried.

Burnaby, B.C.

The new electric lighting system was put in operation in December and practically every settled portion of Burnaby is now lighted with arc lights. The installation was made by the B. C. E. Ry. Co. The total number of lights is one hundred and twenty-five.

Calgary, Alta.

By-law will be submitted January 29 to expend \$368,000 on extensions to the power and lighting systems.

Chatham, Ont.

The council will consider shortly the installation of better lighting on Wellington street.

Cornwall, Ont.

The ratepayers expressed themselves as favoring municipal ownership of electric light and gas, but opposed buying the present plants.

Crediton, Ont.

The Hydro-electric by-law passed by a good majority.

Edmonton, Alta.

The passenger traffic on the street railway system for December is almost double that of a year ago. The gross receipts amount to \$27,328.

The following by-laws will be submitted: \$602,000 for street railway purposes; \$210,000 for power house; telephones, \$325,000.

The city of Edmonton, City Engineer, A. J. Latonell, will call for a supply of 15 new cars. Car barn extension will also be built.

It is probable that during 1912 another 2,000 kw. turbo-generator will be added and it is understood that at the present time the power plant superintendent is in communication with manufacturers of electrical machinery. A turbo-generator or rotary converter of 750 kw. capacity will also be required.

Fredericton, N.B.

The Public Utilities Commission meet here on January 18th to take up the question of the proposed new schedule of rates for electric light and power submitted by the Fredericton Gas Light

Company. Telephone rates may also be considered.

The street lighting system was temporarily out of commission owing to an accident at the generating station.

The Eel River Light, Heat and Power Company have filed plans for the expropriation of certain lands required in connection with the development of power on the Eel River. At the point where the plant is likely to be built there is a fall of 50 feet and a minimum capacity of 700 h.p. It is expected that work will be commenced in the early spring. Engineer Ferguson in charge.

Forest, Ont.

The by-law to take over Forest Electric Light plant and operate it as a municipal concern carried. Extensive improvements are planned.

Fort Frances, Ont.

The Ontario and Minnesota Power Company has applied for an injunction to restrain a number of lumber companies from damming up the waters near the head of the Rainy River. It is claimed by the power company that these dams interfere with the even flow of the water, which threatens to make their plant inoperative at certain periods.

Galt, Ont.

Up to the present time the manufacturers of this town are using a total of 370 h.p. in motor equipment. All this power is obtained from the Hydro-electric Power Commission's distributing station.

Halifax, N.S.

The Maritime Coal, Railway and Power Company, will, during the coming year make extensive installations for the electric operation of the Joggins Mine. They have already installed an electric coal cutter which has a capacity of 160 tons a day. A number of others will be installed this year.

A statement of the earnings of the Cape Breton Electric Company for the twelve months ended October 31, 1911, shows gross earnings of \$334,625 and net of \$160,424, an increase in net over the preceding year of \$9,771. After meeting interest charges and taxes and making provision for sinking and improvement funds, there remained on hand a balance of \$86,616, an increase of \$9,895. Dividends on the preferred stock of the company have been paid semi-annually, May 1 and November 1, at the rate of 6 per cent. since November 1, 1906. An initial dividend on the common stock of 12 per cent. was paid November 1, 1910, and a dividend of 2 per cent. was paid May 1, 1911. The company's bond issue is \$928,000, while it also guarantees the bonds of the subsidiary company, the Sydney & Glace Bay Railway Company amounting to \$195,000.

Hamilton, Ont.

It is said the Hamilton, Waterloo & Guelph Railway Co., president, Paul J. Myler, general manager Canadian Westinghouse Co., and John Patterson, pro-

moter, will commence work next summer. The International Bond & Share Co., New York, is behind the project. To preserve charter, work must be under way by July 1st, 1912.

Tenders on erection and equipment of Hughson street station will be next in order. Site purchased. Plans, etc., with Engineer E. I. Sifton.

Hull, Que.

The E. B. Eddy Co., Ltd., will make the following extensions: New steel reinforced concrete bulkheads and side walls to surround the present forebay; a power house of reinforced concrete; new hydro-electric plant having 3 units of turbines and generators to develop 4,500 to 6,500 h.p. each; present pulp mill to be removed to make room for the large hydro-electric power house and equipment; new fireproof, reinforced pulp mill to be built on Aylmer road.

Kamloops, B. C.

The by-law to spend some \$300,000 on an hydro-electric development plant on the Barrier River was defeated. An auxiliary steam plant will be installed to serve the present requirements.

Kingston, Ont.

The Grand Trunk Railway Company is negotiating with this city for the supply of from 500 to 1,000 h.p. for the operation of their granite quarry some four miles east of this city. It is understood that the Hydro-electric Power Commission, through its chairman, has suggested that a contract be closed with the company as it is expected the Commission will be able to deliver power in Kingston early in the year. This, however, will only be possible if arrangements are made with the Electric Power Company to extend their line.

Lachine, Que.

The town of Lachine is said to be planning an Hydro-electric plant.

Lindsay, Ont.

This town is pointed to as being the only one that has refused the proposition of the Hydro-electric Commission. The citizens of Lindsay, however, are in nowise worried and believe that in their agreement with the Seymour Power Company they have a much cheaper and more satisfactory proposition than the Hydro-electric could give them.

Lucan, Ont.

The Midland Electric Railway bonus by-law was carried.

Lake Megantic, Que.

A deputation recently waited upon Hon. Mr. Allard, Minister of Lands and Forests, asking that the corporation of Lake Megantic be given the control of a certain water power on the Chaudiere River. This is a small falls at St. George, Beauce County, capable of developing an average of about 350 horse power.

London, Ont.

It is said the London Street Railway

Co. would be willing to dispose of its plant to the city. The price mentioned is \$800,000.

The London Street Railway Company is considering the erection of a bridge and extending the railway to form a new belt line.

O. E. Fleming and W. W. Wollatt, representing the Lake Erie Coal Company, of Walkerville, have offered to lease the London and Port Stanley Railway and spend \$400,000 in electrifying it and making extensive improvements.

The water commissioners report a surplus of \$6,392 in the electrical department for the past year. It appears, however, that this does not include the 1.8 per cent. sinking fund, nor any interest charges on the original cost of the plant, nor any depreciation account.

Moose Jaw, Sask.

The lighting of the city streets has been finished temporarily. The new iron standards will not be installed until spring.

Nanaimo, B.C.

The question of an electric road for this city will be taken up by the new council. A Mr. Waller, representing an English firm asks that time be given them to send an engineer over from England after which a definite proposition would be submitted.

Niagara Falls, Ont.

The foreign affairs committee of the United States Government is considering legislation under the International Treaty to succeed the Burton Act, which expires in the near future. An effort is being made by representatives of the Ontario and other power companies here, to allow importation of a larger percentage of energy generated on the Canadian side into the United States.

North Battleford, Sask.

The ratepayers passed the following by-law: Waterworks and electric light extension, \$94,000.

Ottawa, Ont.

On the completion of Bank Street Bridge it is said the Ottawa Electric Railway Company will extend its electric line to Ottawa South via Bank, Cameron and Riverdale streets.

Portage la Prairie, Man.

The new electrically operated pumping outfit recently installed here was put into commission early in January. Superintendent R. J. Hill had charge of the electric side of the installation.

The request for a supply of power from the Winnipeg municipal system has not been received with as much favor as was hoped. Portage is not in a position financially to build their own transmission line at the present time and the Winnipeg council has intimated that they will not undertake the work. Winnipeg offers to sell power at their own city limits but will not transmit beyond that point. It is said that the alternative offer of the Great Falls Power Company to supply this city at \$35 per h.p. will be accepted.

Quebec, Que.

Under the new arrangement with the Dorchester Electric Company, the city

will receive its energy for street lighting at the rate of 7c. per kw.h., as compared with the old rate of 12 cents.

Richmond Hill, Ont.

On January 1st the ratepayers approved a by-law to raise \$5,000 to provide electric power for lighting purposes.

Renfrew, Ont.

Some time ago \$82,000 was voted by the ratepayers for the construction of an hydro-electric plant for light and power supply to this town. It has since been shown that an additional 300 h.p. could be obtained by properly conserving the storage areas and a further sum of \$60,000 has been voted to develop the full amount of power. John B. McRae, consulting engineer.

Saskatoon, Sask.

The electric light and power department are considering a new schedule of rates for both light and power. These entail, it is said, a reduction from the present rates of from 20 to 25 per cent. Mr. A. G. Sangster is electrical superintendent.

Seaforth, Ont.

It is said the light commissioners intend discarding the floor space method of lighting and installing a straight meter rate of 10 cents per kw.h. instead.

Stratford, Ont.

It is calculated that the total revenue from the Stratford Lighting System for the year 1911 will amount to \$29,419, as against a total expenditure of \$28,605. This expenditure apparently does not include any percentage towards the general sinking fund. The showing, however, is considered to be a very good one.

Sherbrooke, Que.

The Bell Telephone Company and The People's Telephone Company are arranging a form of amalgamation. It is understood the Bell company takes over the city business, leaving outside business in Eastern Townships—total business to be divided as a percentage. Permission to be obtained from Quebec Legislature. Amalgamation in operation about March 1st, 1912.

St. Thomas, Ont.

The by-law re extension of electric railway system to Port Stanley was defeated.

The council will consider shortly the placing of cluster lights and iron standards on main streets here.

St. Maurice, Que.

The St. Maurice Hydraulic Co., are planning the installation of a telephone system for their transmission lines.

Sandwich, Ont.

The Essex Light & Power Company have deposited plans with the Minister of Public Works at Ottawa, and with the County Registrar here of six proposed power cables to be laid under the Detroit River for the supply of light and power on the Canadian side. This company was recently incorporated by Mr. Stuart, who is already interested in a number of Canadian plants in the neighborhood of Detroit. It is understood power will be purchased from the

Detroit Edison Company, and supplied to the Canadian towns by Mr. Stuart's company.

South Vancouver, B.C.

It is probable that in the near future negotiations will be opened with the Western Canada Power Company for the supply of electric energy here.

The second generator is placed and will be held as an auxiliary in the meantime.

Truro, N.S.

The Chambers Electric Light Company, of this place, have submitted three propositions to the town, neither of which meets the approval of the council. In the meantime temporary arrangements have been made and there is some talk of a municipal lighting plant being installed.

Toronto, Ont.

The following municipalities voted in favor of hydro-electric power:—Ailsa Craig; Blyth; Brampton; Brussels; Cal- edonia; Clinton; Cornwall; Exeter; God- erich; Hagersville; Hastings; Hensall; Kincardine; Kingston; Lakefield; Lis- towel; Lucan; Owen Sound; Paisley; Paris; Peterboro; Prescott; Richmond Hill; Southampton; Tillsonburg; Thorn- bury; Welland; Wingham; Wroxeter.

It has been stated by the Hon. Adam Beck that the Hydro-electric Commis- sion is considering a site near Stanley Barracks for an experimental testing station.

An improved style of street lighting has been inaugurated on Palmerston Boulevard. The lights are located on the tops of pillars and the wires buried underground. House service will be supplied from poles in the lanes, at the rear of the houses.

The ratepayers carried the by-laws to raise \$2,200,000 for hydro-electric exten- sion and \$139,488 for a Danforth avenue car line.

Application has been made to the On- tario Government for a charter to build an electric line connecting Lambton along the Humber River to Sunnyside, the terminus of the Toronto Street Railway system in west Toronto. The line would be known as the Humber Valley Street Railway and is an auxil- iary to a scheme being worked out to reserve the banks of the Humber as a fine residential district. Some opposi- tion to this road has developed on the Toronto city council.

Messrs. Page & Co., Toronto, have the contract for completing the con- struction of the power house of the Elec- tical Development Company at Niagara Falls.

Vancouver, B.C.

Point Grey on the 13th defeated a by- law for granting a long term franchise to the B. C. E. R. Company.

Vernon, B.C.

The electric railway which the C.N.R. will build along the Okanagan Valley is making progress. The line is now be- ing staked out. Power will likely be obtained from Shuswap Falls, which is situated about 25 miles from this city.

Victoria, B.C.

Mr. R. B. McMicking, local manager of the B. C. Telephone Co., has stated that he is not aware of any intention

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on the part of his company to increase the telephone rates in this city.

West Toronto, Ont.

The Interurban Electric Company is negotiating with the Etobicoke township council regarding a supply of light and power in Lambton, Islington and certain new Toronto districts. It is said that the rates offered by this company are lower than those quoted by the Hydro-electric Power Commission.

The York Township Council will submit a by-law asking authority to close a contract with the Toronto Suburban Railway Company for an extension of their line from Weston to Woodbridge, a distance of approximately eight miles. Mr. Geo. C. Royce is manager of the Toronto Suburban Railway Company, which is a subsidiary of the Toronto Railway Company.

Welland, Ont.

Mr. F. Swayze, formerly with the N. S. & T. Railway Company, has been appointed general manager of the Niagara, Welland and Lake Erie Electric Railway, which has just completed its line through Welland town.

White Rock, Kings Co., N.S.

It is reported the Nova Scotia Power Company is being merged with a similar concern with interests on the Mersey river in Queens County and perhaps, also, with the Halifax Electric Tramway Company. Plans are being prepared for a power house on the Gaspeare River, at White Rock, requiring 6 dams, each 175 ft. to 500 ft. long by 8 ft. to 20 ft. high; $2\frac{1}{2}$ miles of canal; a wooden flume 8 ft. x 8 ft. x 5 miles; 2,000 feet steel penstock; over 120 miles of transmission line, steel towers. A Foster, resident engineer, Kentville, N. S.

Winnipeg, Man.

Tenders have been called by the city of Winnipeg for the supply of one 250 kw. motor generator exciter set with accessories complete.

The citizens of Winnipeg some time ago seemed anxious for an all-night service which the company was bound by their agreement to give when the population reached the 100,000 mark. The council has now decided that they will be satisfied with a service up to 2 a.m., with regular fares between midnight and that hour. It is suggested that the company might concede this request if the city agrees to give up its right to an all-night service.

An auxiliary steam plant is suggested by the Winnipeg municipal authorities. It is said that the gas engines at the high pressure plant could be kept in readiness and would supply power for a maximum of 3,000 h.p. equipment.

On Tuesday, December 19, the by-law to give a 20-year franchise to the Hill & Springfield Electric Railway Co., in Springfield, Man., was defeated.

Woodstock, Ont.

By-law carried to raise \$10,000 for extension of street lighting system carried.

Yorkton, Sask.

The power plant was destroyed by fire on January 10th. Work was immediately commenced on its reconstruction.

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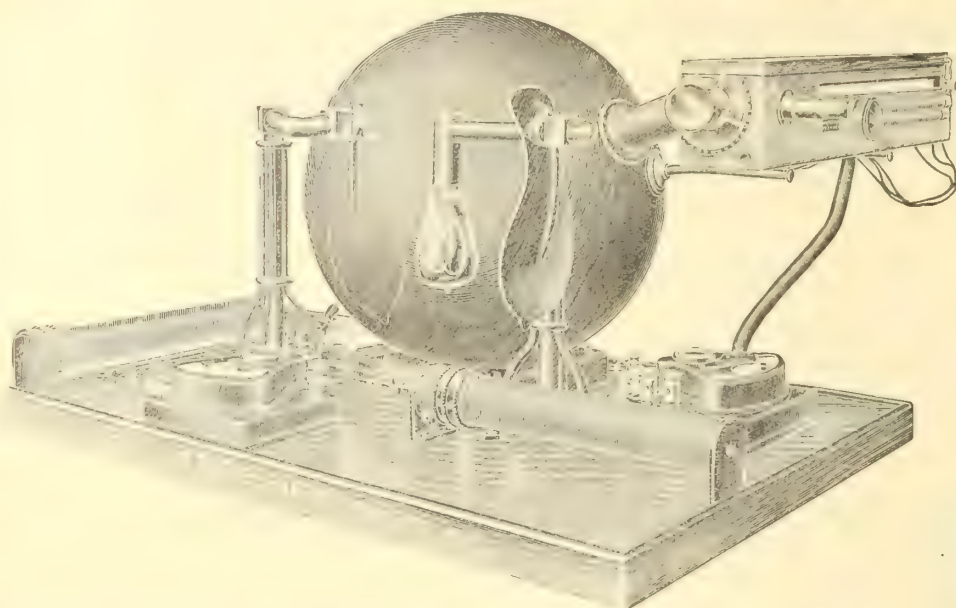
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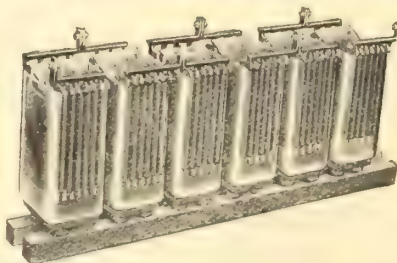
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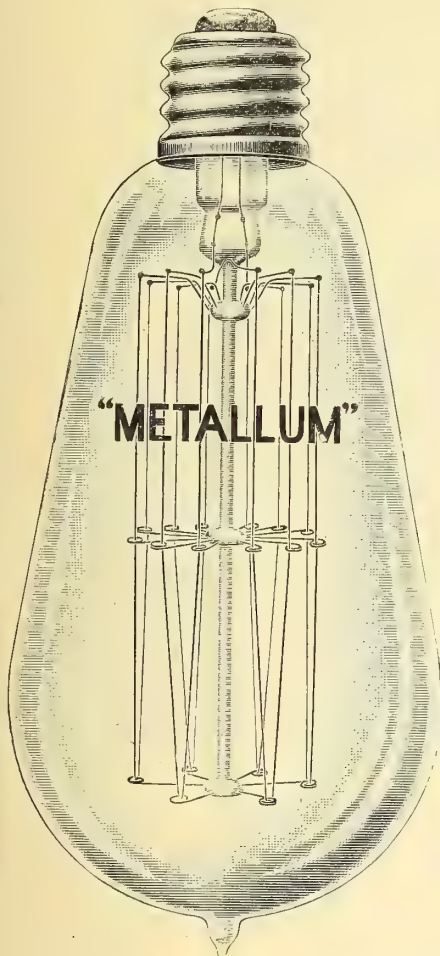
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All Voltages
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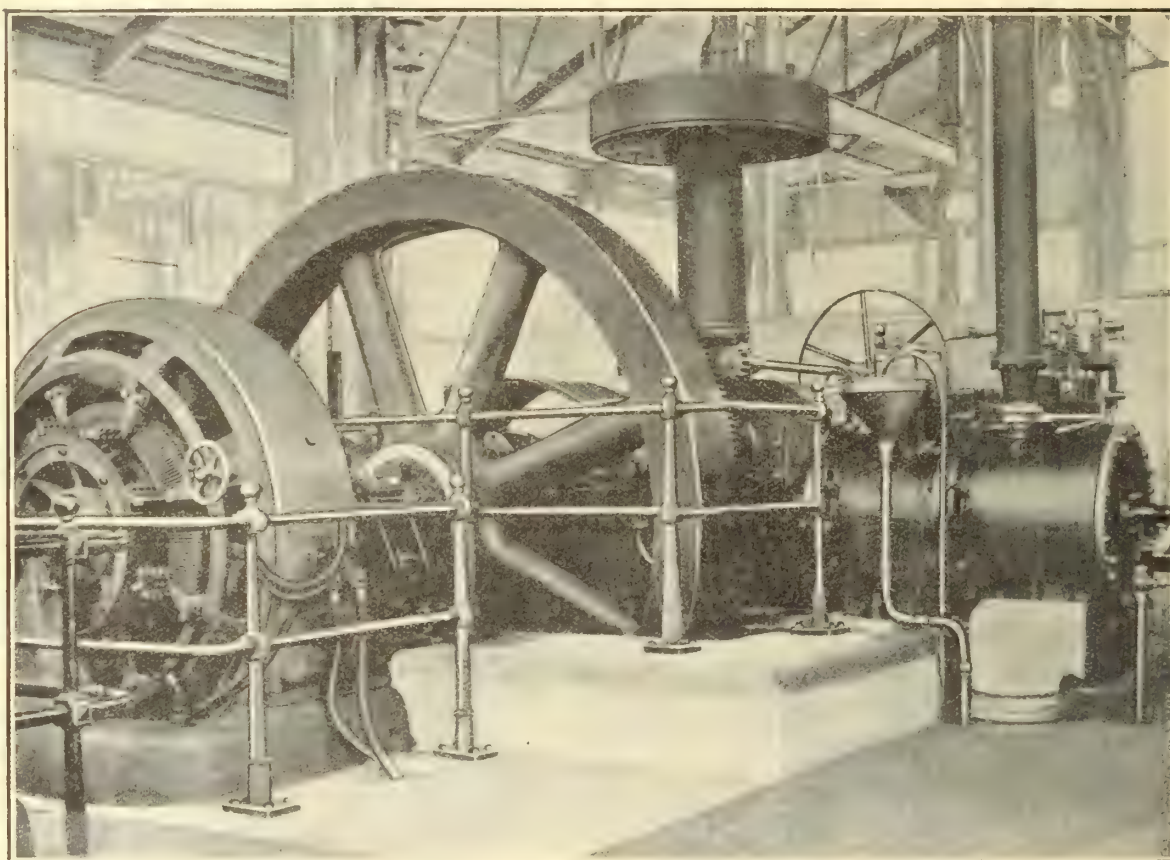
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Canada Gas Producers and Premier Gas Engines

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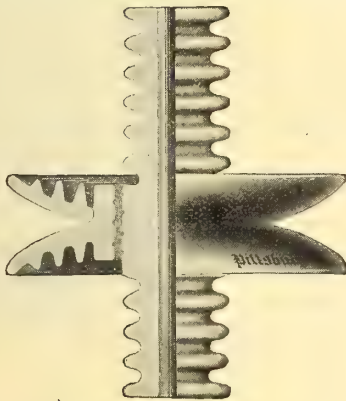
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STEEL — (Not Cast Iron)

Are the most Modern Fittings for Exposed Conduit Work

ONCE TRIED - ALWAYS USED

Because they are much lighter and stronger and at the same time giving more room in the box to do the work than is found in cast iron boxes. They are also very neat in appearance and are now used by the most exacting contractors throughout the land because they **make the job**.

Made in all types and sizes from ½" to 1½"



No. 0



No. 6



No.



No. 2



No. 5L



Metal Nipple Cover



Blank Metal Cover



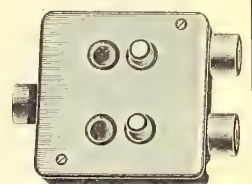
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Specify 'Appleton'
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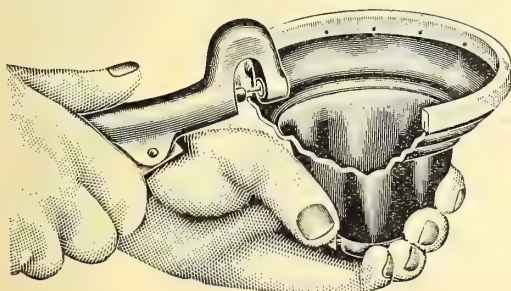


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APPLETON ELECTRIC CO.

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CANOPY INSULATORS



No. 1

PATENTED APRIL 15th, 1911

No. 1. Shows method of fastening Strip Insulator without brads or rivets.

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4" and 10" curles contain from 64" to 66". One 4" curles contains sufficient Insulation for four 5", three 6" or two 10" shells.

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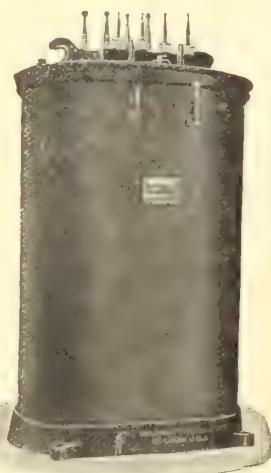
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Stop and Figure Your Transformer Cost



Not the cost of purchase and installation, but the cost of upkeep and copper loss.

Moloney Transformers, owing to the high grade Silicon Steel used in their core and to their perfect design, have reduced core loss to a minimum.



Moloney Transformers will effect a saving of 20 per cent. in one year over ordinary transformers, and in five years the price of a new transformer. This is not an empty statement but a proven fact.



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"A" SPLICING COMPOUND.

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Liquid and Rubber Insulation

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Imagine the folly of entrusting the efficiency of a burglar alarm system to two sickly, uncertain batteries in the basement! While they would be making up their mind a



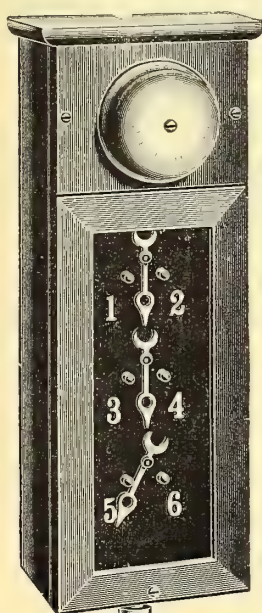
THORDARSON Junior Bell-Ringing TRANSFORMER

would have roused the whole neighborhood. It uses good live current; injects a healthy vigorous ring into bells, buzzers and burglar alarms that means business. 30% more efficient than any similar transformer. Current will not register upon ordinary watt meter. Easy to put up—easy to sell. Why not stock up with it?

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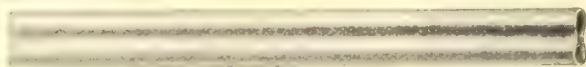
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A Seamless Drawn Connector which makes a perfect self welding joint exceeding the wire in tensile strength. Three and one-half turns make a perfect joint. No Plugged Sleeves as in the brazed type. Thickness uniform throughout the length. No chance for moisture to enter.

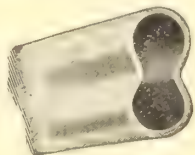
BEFORE TWISTING



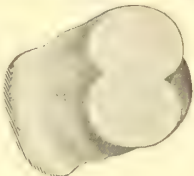
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Sizes
14 to
0000
B.&S.



Sectional
Views
Before
and
After
Twisting



The
Best
Joint
to
Use

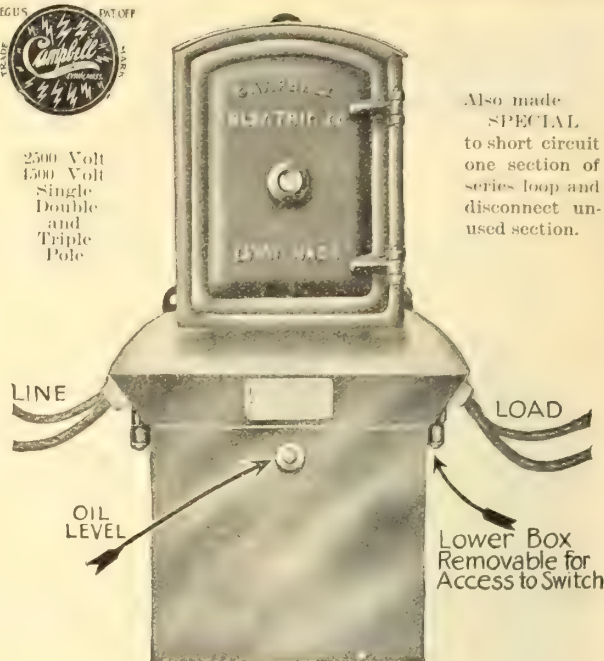
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2500 Volt
1500 Volt
Single
Double
and
Triple
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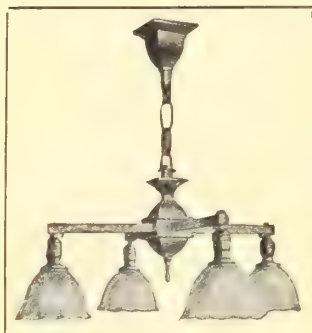
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SPECIAL
to short circuit
one section of
series loop and
disconnect un-
used section.

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Eight Day Time Switch
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TIME SWITCHES—BELL RINGERS.
X-RAY AND HIGH-FREQUENCY APPARATUS.
THERMO FLASHERS. OZONE GENERATORS.



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proposition

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and undoubtedly
are quite well ac-
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of the facts about
it, such as exact
construction, dur-

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You were interested and would have
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line was especially suitable for your business.

Write for a catalogue now and learn of
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Made from hard
white porcelain and
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No burrs or rough
edges to cut insula-
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Vacuum Cleaner

Vacuum, 10 inches mercury basis.
Air displaced, 33 Cubic feet per minute.
Cost of operation, about 1 cent per hour.
Weight, 37 lbs.

A genuine Vacuum Cleaner permanently guaranteed by its maker.

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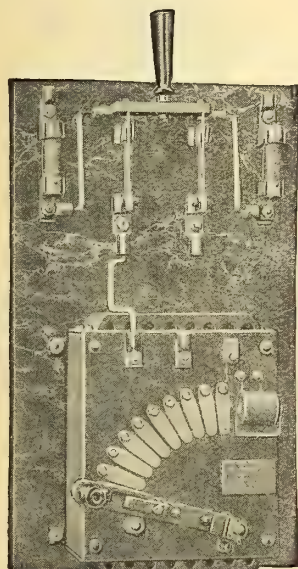
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¶ The ride which takes the place of an entire park—combines the highest type of construction, maximum earning capacity and minimum cost of operation.

Illustrated Booklet, Dept. C

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D. C. "Universal" STARTER

A device for complete installation of motor. Mounted on marbelized slate panel with knife switch fuses ready for connections. Provided with our patented removable segments and self-adjusting brush.

when ordinary controllers and starters are used.

Why not relieve yourself of this constant vigilance and at the same time get the greatest efficiency by installing

"INDEPENDENT" Starters and Controllers

Then you will be sure your motors will start when you want them to, stop when you want them to, and run as you want them to.

In addition to being well constructed mechanically and electrically, Independent Controllers and Starters contain a number of new and exclusive features which no other manufacturer has been able to duplicate.

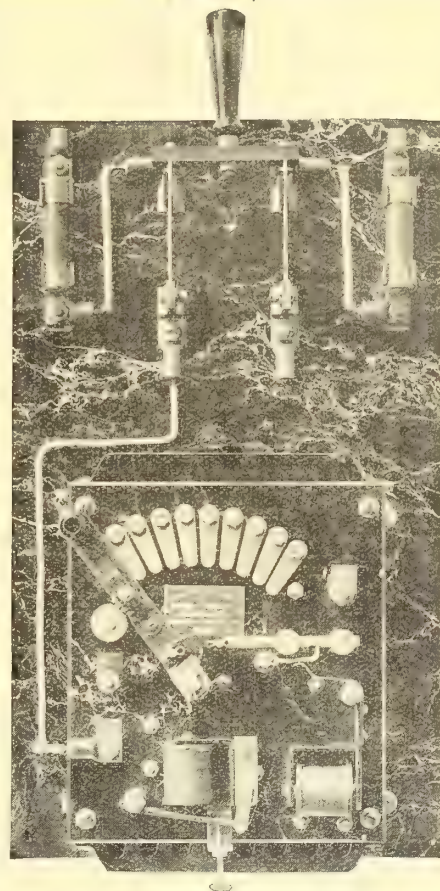
Always dependable, absolutely fireproof. Won't flash over or burn out. Bulletins on request.

Independent Electric Mfg. Co.
Milwaukee, Wisconsin

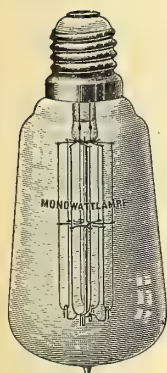
Every Motor Manufacturer, Jobber and Dealer should have a copy of our new 1912 Catalog on his desk. Special Bulletins will be mailed to all who are interested.

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Has our newly-patented improved horizontal ratchet bar, which insures accurate contact. This bar can be replaced at slight expense, a decided advantage over controllers requiring renewal of the entire lever when the ratchet becomes worn.



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"Monowatt" Tungsten Lamps

One watt per candle power
in all sizes. Best Quality

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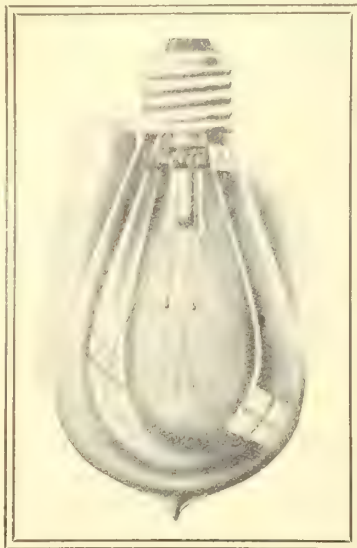
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A few dollars spent in advertising
your proposals in

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would result in additional competition,
which might save your city or town or
your client many hundreds of dollars.

Carbon and Tungsten Lamps



We are Headquarters for anything in Incandescent Lamps

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A lamp that will meet class A specifications. Can furnish either 3.1, 3.5 or 4 watts per candle. Try an assorted lot at our case lot price 13 cents.

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An imported lamp with a very short tough filament. After Dec. 25th there will be very little difference in price between the 25, 40 and 60 watt sizes. Send for a trial dozen or so. We know you will like them and order more.

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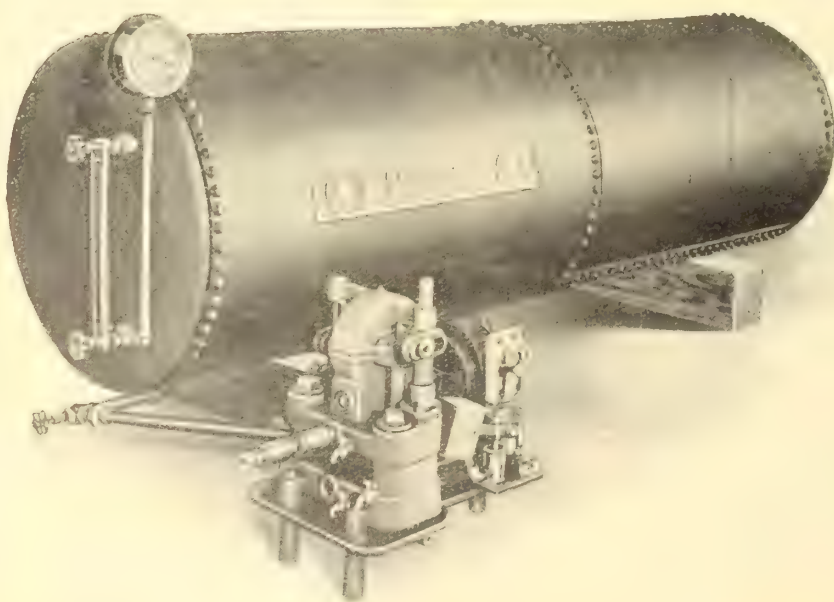
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Installation means more current consumed—more profit for you.

It means to the central station operating a day current—an added profit worth while.

It gives your customers a regular city water service and you supply them your current to pump the water.

We have a complete line of electrically driven pumps for all conditions, especially designed from the standpoint of the inexperienced user and the central station man. Pumps requiring motors from 1/6 H. P. to 15 H. P. and pumping from 100 gallons to 12,000 gallons per hour.

Especially designed with the idea of constant load on the motor so current can be taken from regular line—no interference with lightning service.

Kewanee systems are furnished complete—they are easy to install—easy to operate—easy to understand—hard to wear out—but easy to repair.

Every system carries with it blue print and printed instructions.

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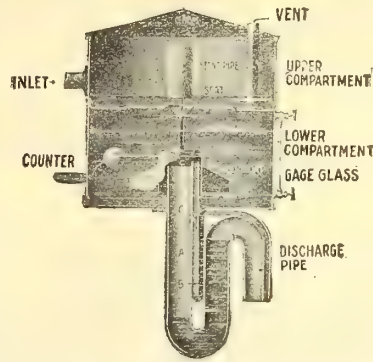
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What **DOES** your steam cost?

Install a Weigher and check your daily coal consumption accurately.

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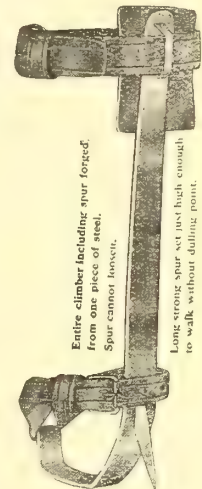


See How the Straps Fit!
The Ring Does It.

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These climbers mean safety and comfort for the lineman as well as greater speed in climbing. Forged from one piece of crucible steel by a special process, the spur cannot loosen. It is shaped so as quickly to get a solid hold on the pole, but it will pull out easily. The ring allows the strap to fit flat on the foot.

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PEERLESS TESTING SET They Make the Following Tests.



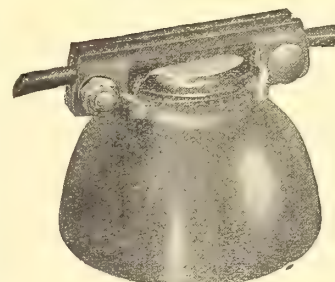
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Size, 8 1/4 x 5 1/2 x 6 in.
Weight 7 1/2 lbs.

Measuring resistance by the Wheatstone bridge method
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Checking up Voltmeters
Measuring Battery resistance
Making the Murray loop test
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Connectors,
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Your telephone line will not give efficient service to subscribers unless your generators produce electrical pressure great enough to overcome the ordinary resistance of the line and in the case of bridging generators, the current forced through by this pressure must be of sufficient quantity to ring all the bridged bells connected across the line.

This Kellogg generator is a giant in strength and its mechanism is absolutely accurate.
It will ring your bells — EASILY — CLEARLY — POSITIVELY.

Send for our Bulletin No. 54

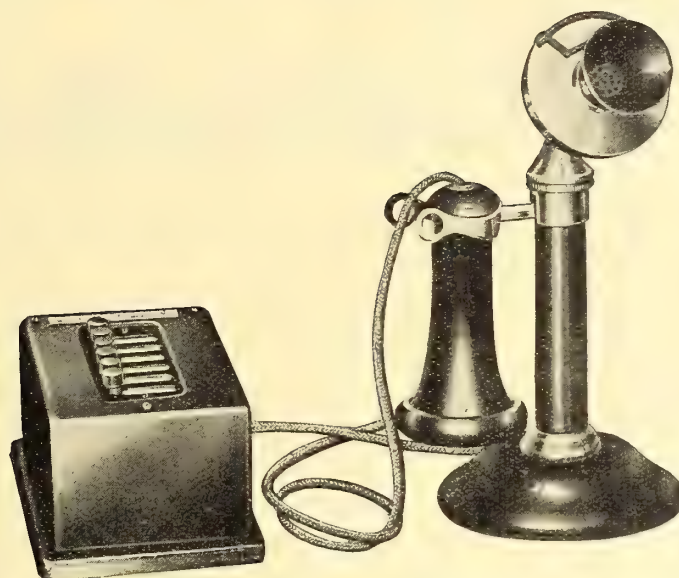
KELLOGG SWITCHBOARD & SUPPLY COMPANY

KANSAS CITY, MO.

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You Must Not Buy a Cheap System



CODE NO. 905 TYPE—6-STATION

INTER-COMM-PHONE

Every business man will consider a means of increasing the efficiency of his organization. You can convince him that the Inter-Comm-Phone System eliminates confusion, noise and demoralization of employees and executives continually running about to receive or carry out instructions. It binds various departments and their heads together into a systematic time and labor saving organization.

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You must not buy a cheap system—expensive to maintain—difficult to install and not up to high standard of the Inter-Comm-Phone's quality.

We make the most complete variety of types in 6- 12- 22- and 32-station capacity. More information will be found in Booklet No. 2669—send for it.

May we ship you a sample instrument?

PREFERRED BY DISCRIMINATING DEALERS EVERYWHERE

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The Art of Getting Next

A system for side-stepping competition—in obtaining news of sales opportunities in advance of your competitors, is worth while investigating.

An organization that covers Canada—with resident agents in every town of importance—trained men, who are constantly on the alert for sales developing data, is worth while finding out about.

A service that guards against oversight and loss of opportunity—that enables you to select that work which offers the most profit and which you can handle to the best advantage, is worth while having.

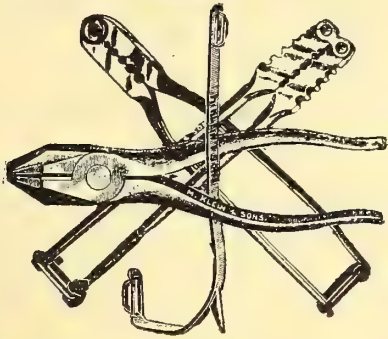
Reports that are dependable, accurate, complete, that reach you in time, that eliminate useless missionary work, that give your salesmen real, live opportunities to follow up, are needed in your business.

Of course, you want to know if we can serve you. If so, send a copy of your catalogue—tell us what you sell and where you sell it. Some other live wire may write **to-morrow**—you write **to-day**.

MacLean Daily Reports

220 King St. West, Toronto





"KLEIN TOOLS"

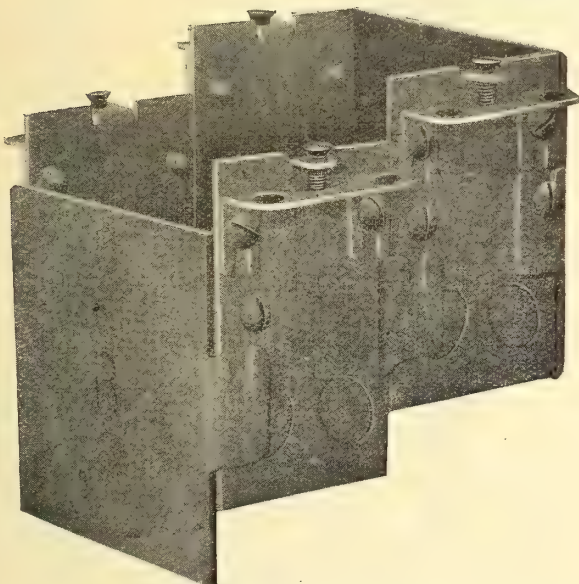
You can't beat 'em in utility, shape, style, weight, hang temper and dependability. That's our opinion—endorsed by that of thousands of linemen who depend on them for a dangerous living.

A good stock carried in Canada by NORTHERN ELECTRIC & MFG. COMPANY, LTD., Montreal, Toronto, Winnipeg, Regina, Calgary, Vancouver. ASHDOWN HARDWARE CO., Winnipeg. GILMER & CO., Winnipeg.

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Manufacturers of Electric Automobiles, Switch Boxes, Spaces. Etc.

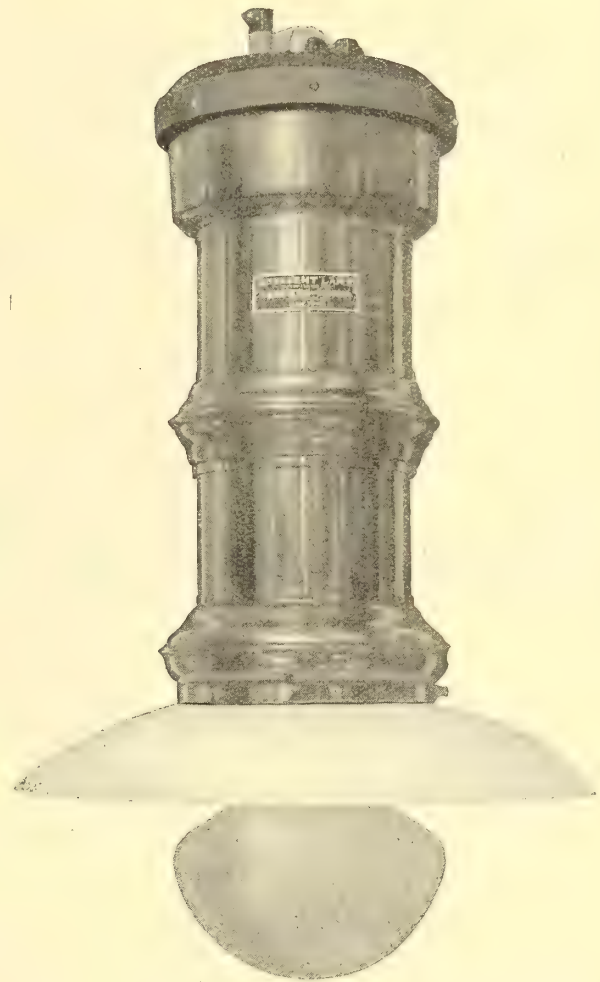
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HIGH EFFICIENCY ARC LAMPS

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SOLE MANUFACTURERS

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AN Electric Dining Room Set



OF SIMPLEX QUALITY

Comprising a stove, chafing dish, coffee urn, tea kettle and stand for holding any one of the utensils not in use, provides attractive hospitality at the supper, or tea table. The **Simplex Clamping Contacts** make a positive assurance of least current for the same result. Finished in nickel, copper, or silver and sold separately or in combination with the stove.

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Simplex Electric Heating Company

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MASS.



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THE MANHATTAN Electrical Supply Co.

Manufacturers of

Telegraph and Telephone Instruments and Supplies

Wireless Outfits

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“Something Electrical for Everybody.”

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CANADIAN REPRESENTATIVE

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Good coffee quickly made—no alcohol lamp—no smell—no annoyance—no danger!



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Factory
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You can have the same success with your exchange by equipping it with automatic apparatus.

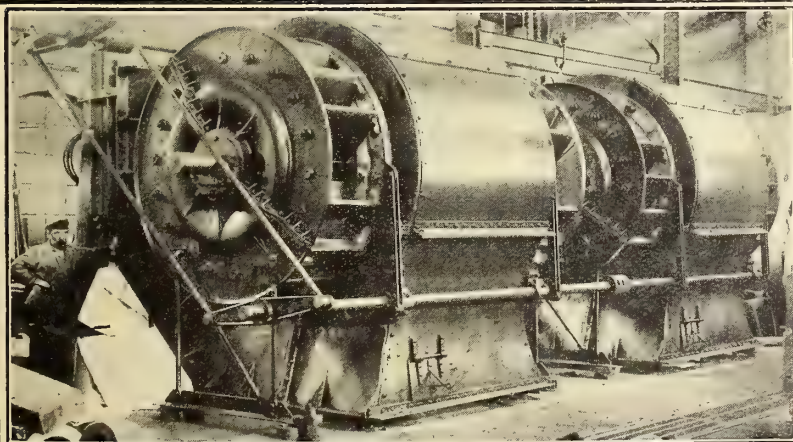
AUTOMATIC ELECTRIC COMPANY - Chicago

Elliot Bros. Electrical Instruments



Electrical Machinery

The Lancashire Dynamo & Motor Company
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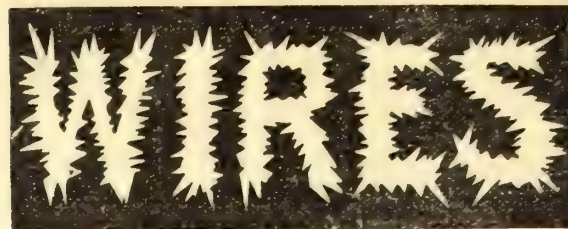
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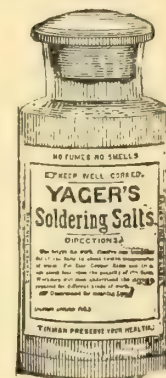
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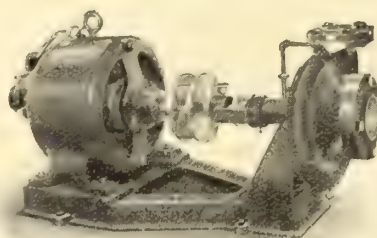
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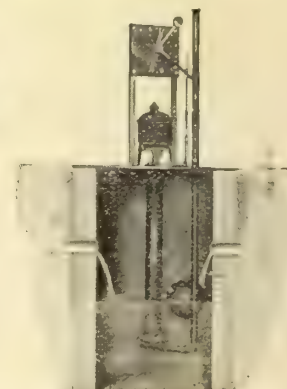
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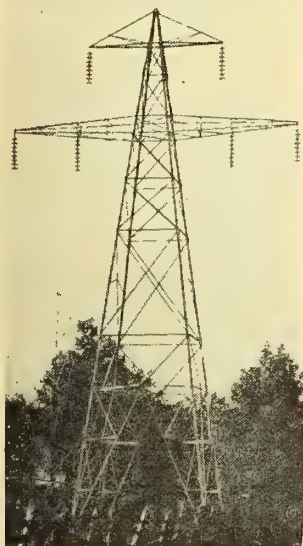


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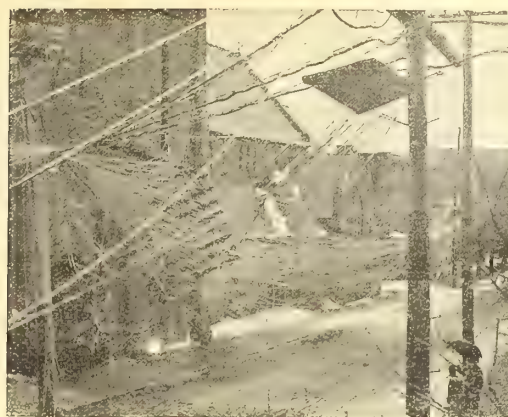
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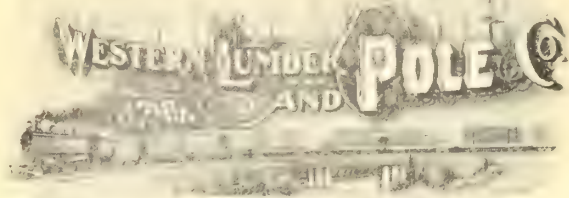
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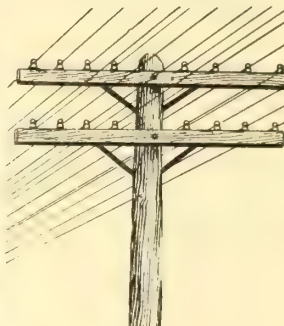
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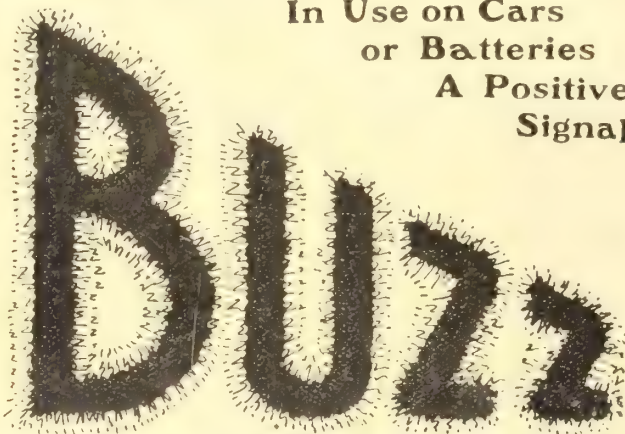
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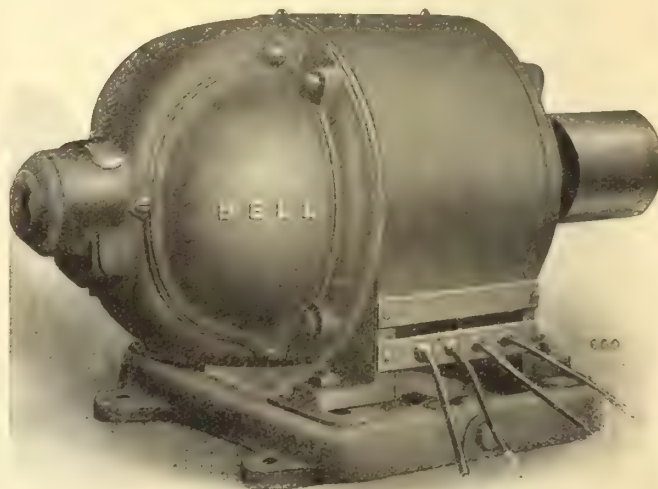
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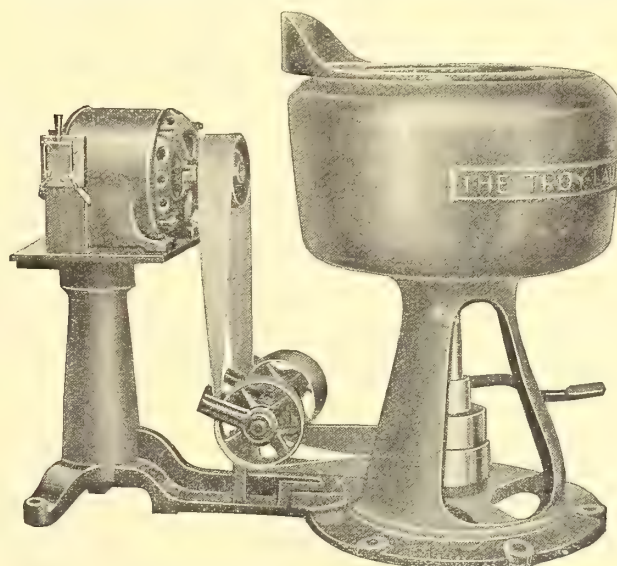
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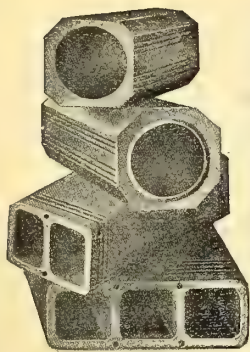
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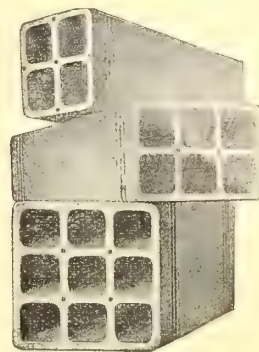
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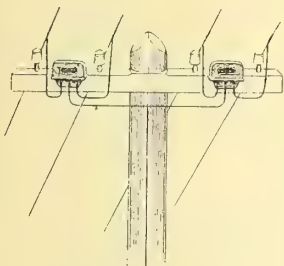
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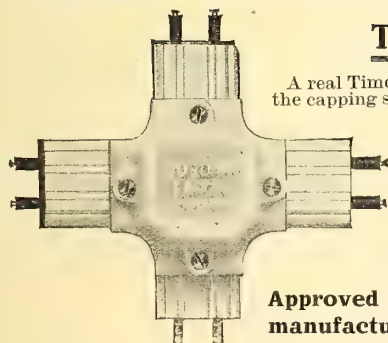
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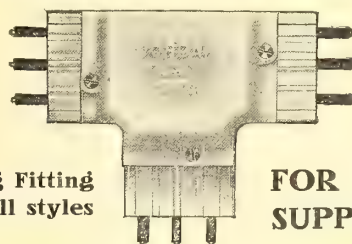
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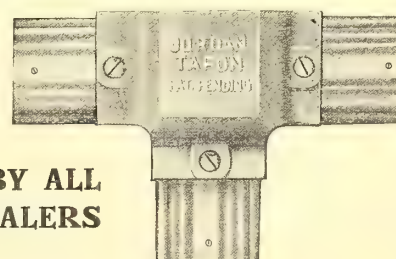
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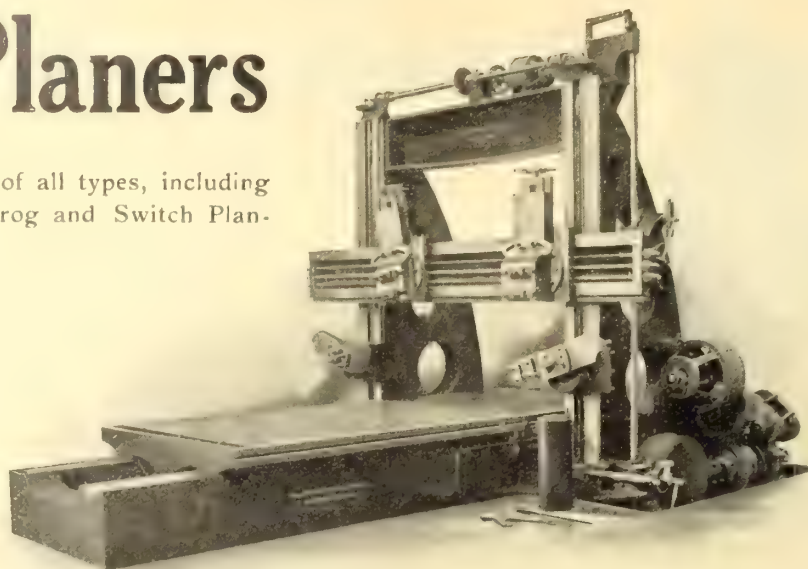
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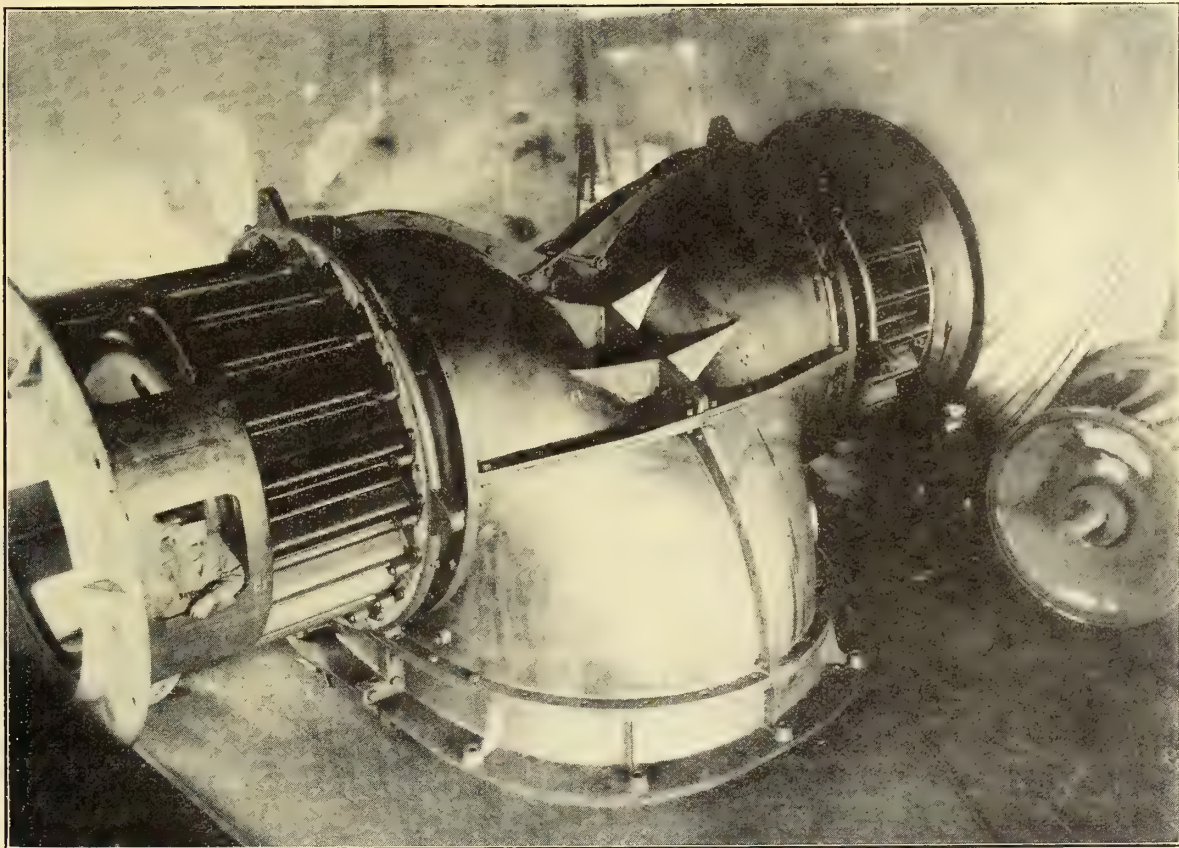
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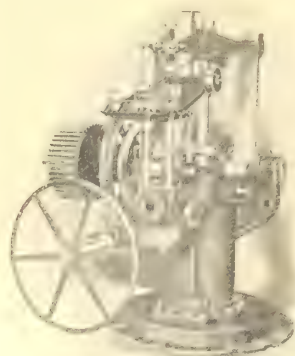
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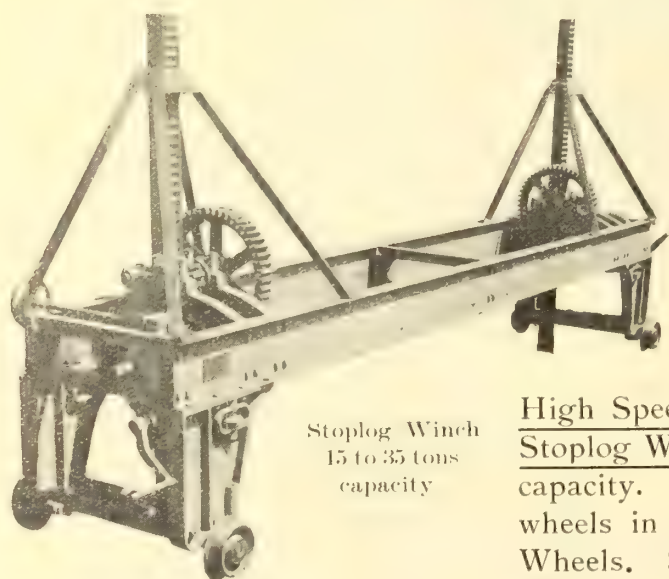
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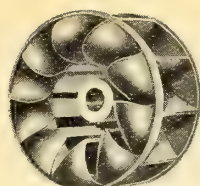
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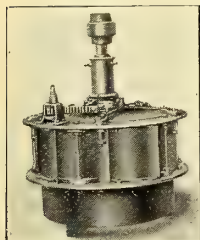
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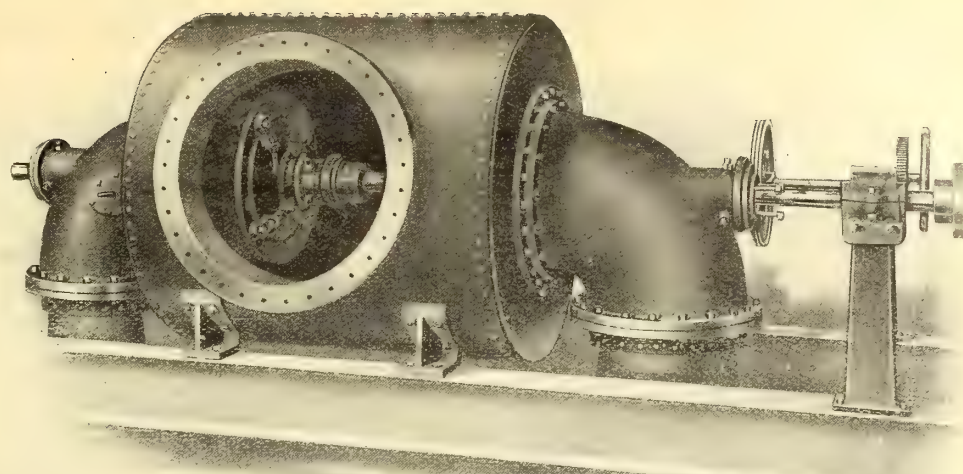
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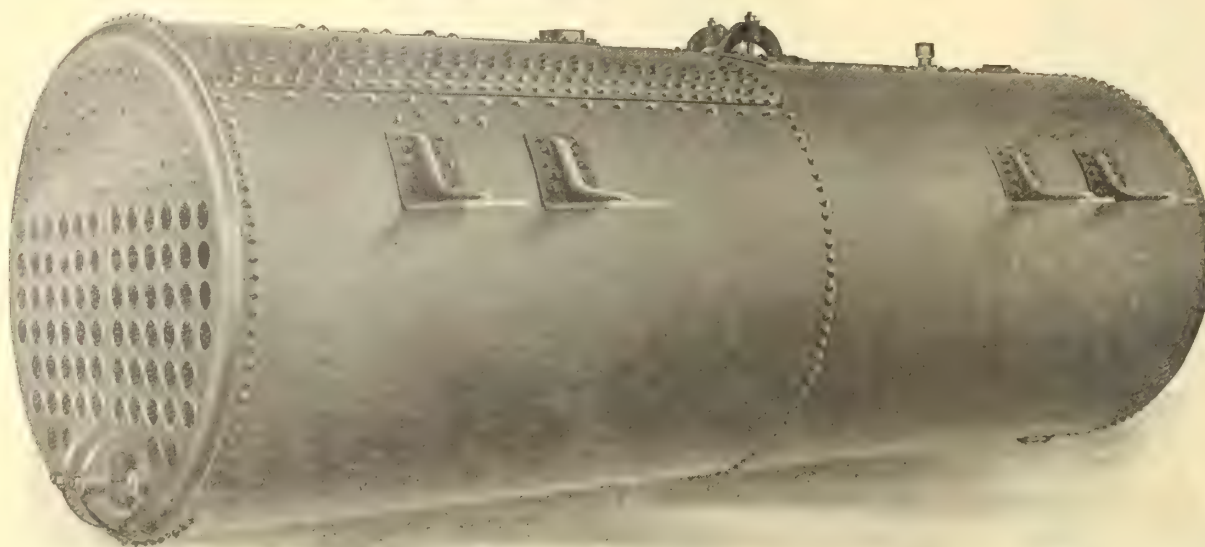
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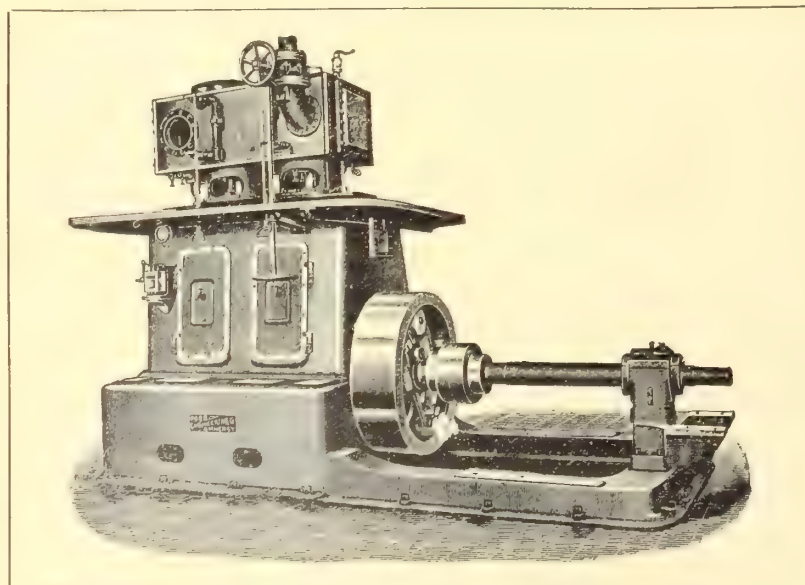
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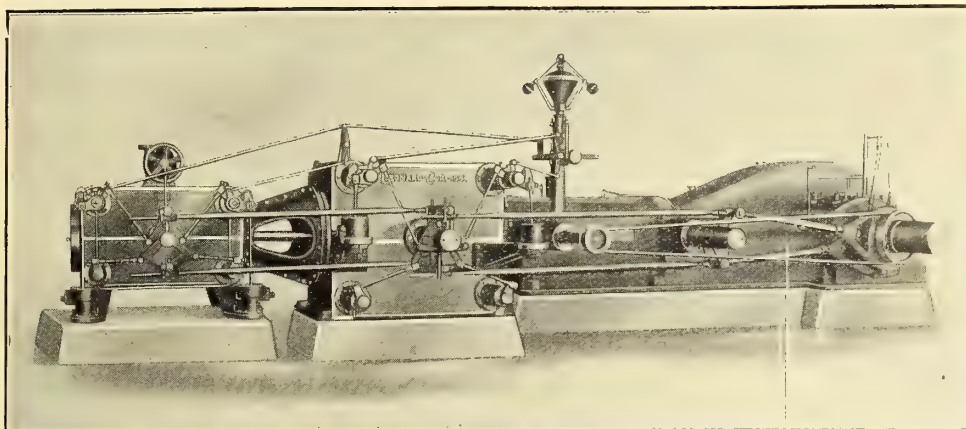
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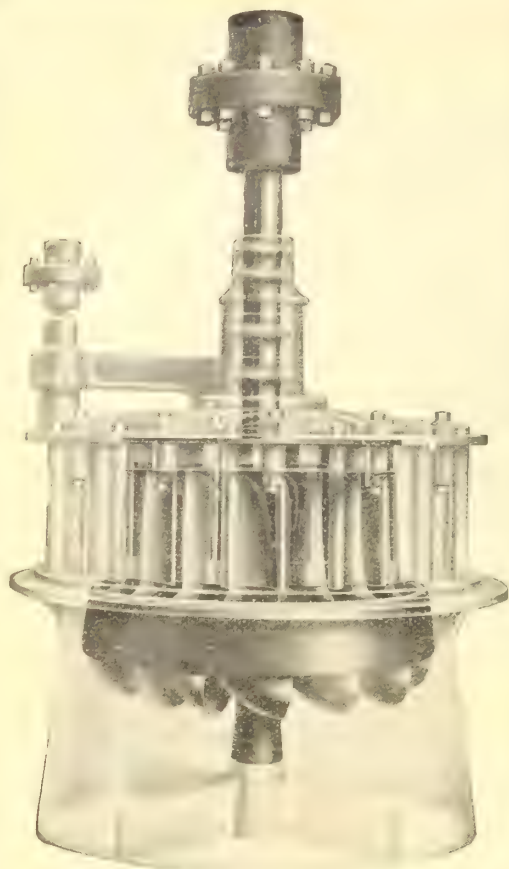
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The Theory and Practice of Every Phase of Electrical Communication is thoroughly covered

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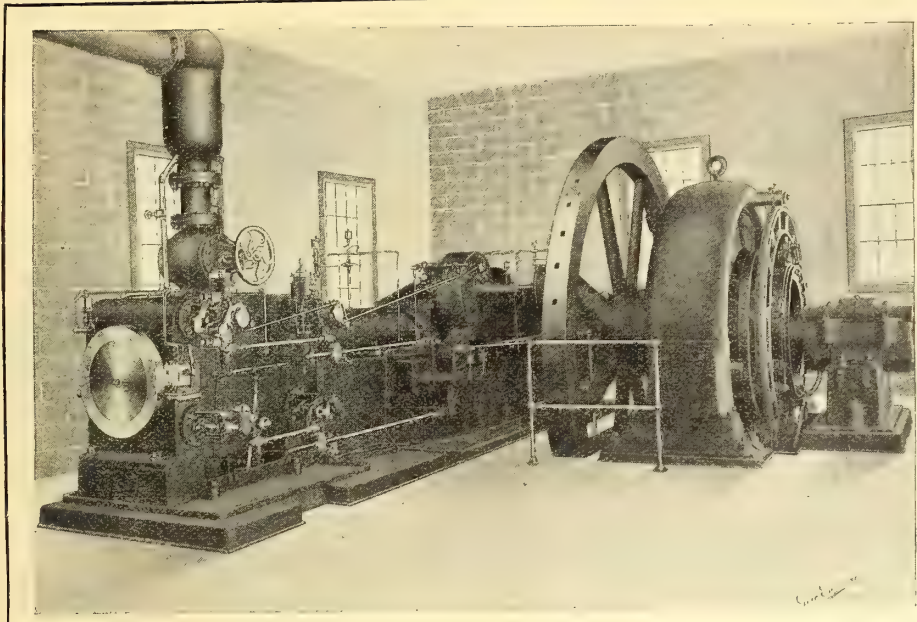


Illustration shows one of 3 Heavy Duty Goldie Corliss Steam Engines built and installed by us for the Sandwich, Windsor and Amherstburg St. Ry. at Windsor, Ont.

Goldie Corliss **Steam Engines**

are to be found
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Plants in Canada

THE REASON IS
they give a
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for a
Minimum Cost of Maintenance

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Unique Experience

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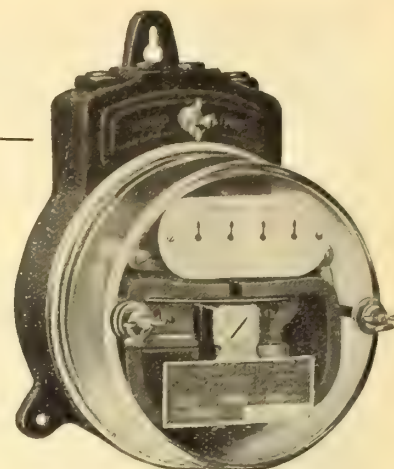
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LUMSDEN BUILDING
408

10 Reasons

for using only Westinghouse
Type C Watthour Meters
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1. Accuracy of registration within 2 per cent. from 2 per cent. of full load to 50 per cent. overload.
2. Permanency of calibration for long periods.
3. Absence of temperature, wave form, power factor, frequency, external field, or voltage errors.
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5. Separately sealed terminal chambers of heavy construction and with heavy, double screw-terminals
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Folder 4217 describes Type C Watthour Meters in detail

**Canadian Westinghouse Co., Limited,
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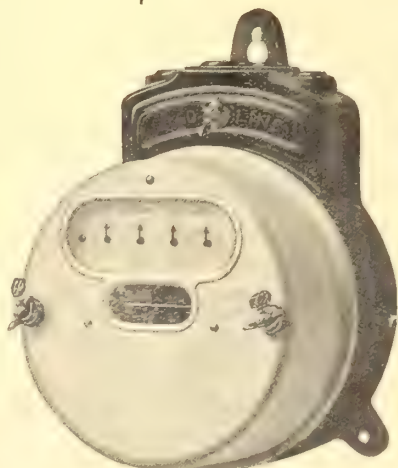
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We concentrate on Electrical Repairs. That means that your trouble work will not be side tracked to get out new machines on order with delivery promised by a sales force not in touch with the repairs in hand.

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That is why we are acquiring and holding the work of a large proportion of the Ontario Power Companies.

That is why we will acquire and hold yours.

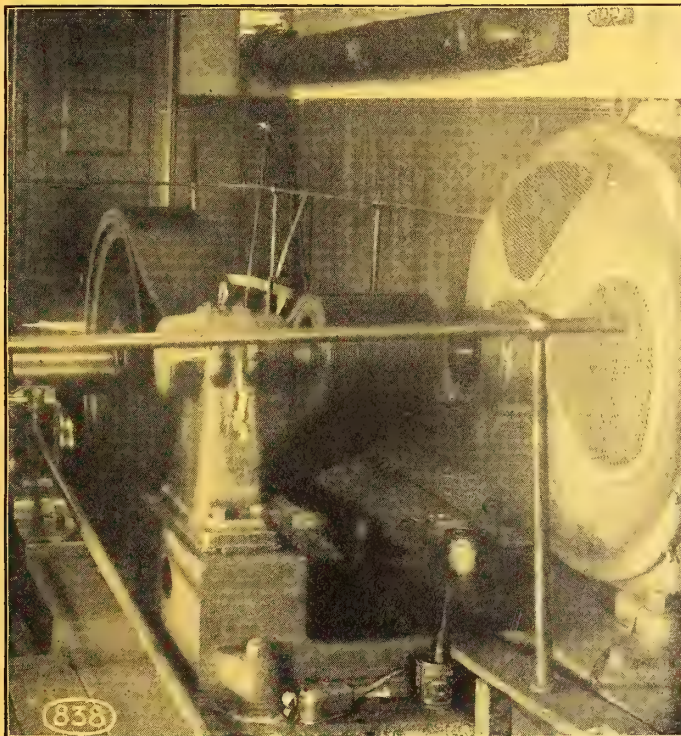
THINK IT OVER

The Electrical Maintenance & Repairs Co., Limited

162 West Adelaide Street, **TORONTO**

Phone Adelaide 902-903

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**TRANSMITS ANY POWER FROM
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Send us following details of any troublesome drives or new drives and we will give promptly full information re chain driving.

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A Sketch of the drive is always of great assistance

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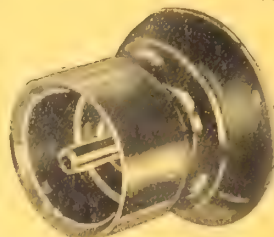
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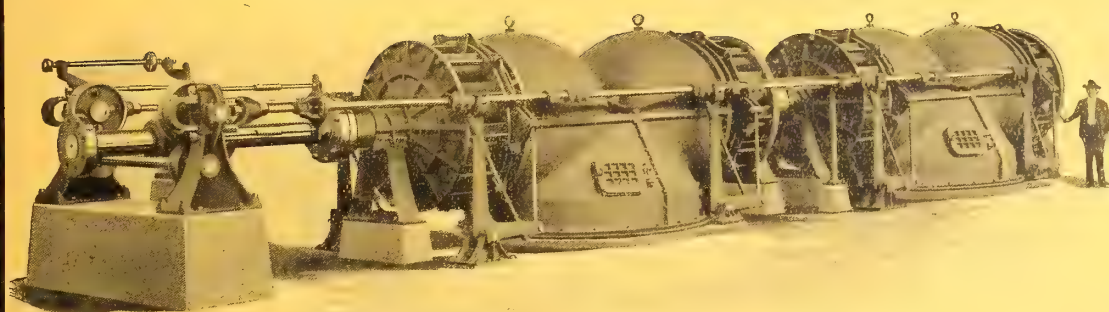


Type "MHS," 2, 3, or 4
Conductor.
30,000 Volts. One of many types.



Electrical News

Generation, Transmission and Application of Electricity



Hydraulic Turbines

One Unit of Turbines of 3,200 H.P. 30' Head Furnished

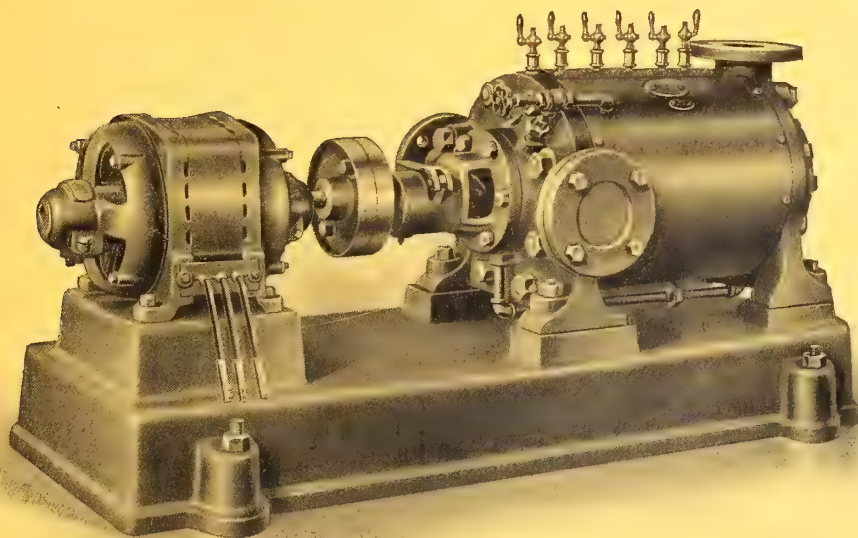
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Turbines Furnished for Heads from 5 feet to 600 feet.

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Electrically Operated Mather & Platt Patent Turbine Pumps for all duties



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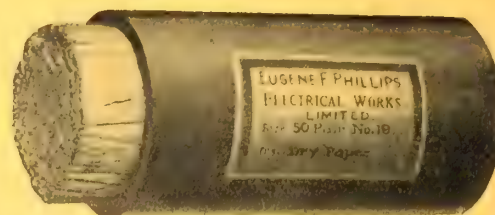
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Railway, Feeder and Trolley Wire

Weatherproof Magnet
and Rubber Covered
Wires and Cables



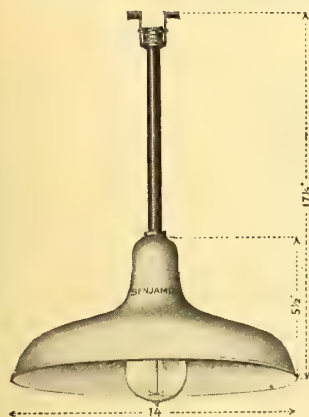
Incandescent and Flexible Cords

Eugene F. Phillips Electrical Works, Limited

MONTREAL - - CANADA

Branches: Halifax, Toronto, Winnipeg, Vancouver

LET THE LIGHT SHINE



Cat. No. 6061 19" over all

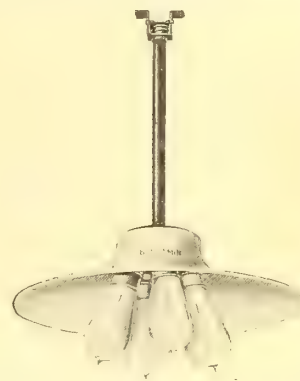
Enamelled Steel Reflector
Galvanized Iron Stem
Shock Absorber

SO IT WILL BRING EFFICIENCY AND OUTPUT UP TO A POINT NEVER BEFORE EQUALLED. MANUFACTURING, RAILWAY AND OTHER COMPANIES ARE CALLING MORE AND MORE EACH DAY FOR

EFFICIENCY and INCREASED OUTPUT

Without one you can't secure the other

INTELLIGENT ILLUMINATION IS THE RIGHT ROAD TO EFFICIENCY; EFFICIENCY INCREASES THE OUTPUT.



Cat. No. 0634. 20" over all

2, 3 or 4 Light. Enamelled
Steel Reflector. Galvanized Iron Stem

INDOOR

BENJAMIN

OUTDOOR

REFLECTOR SOCKETS

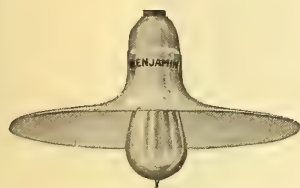
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REFLECTORS

CAREFULLY DESIGNED TO MEET EVERY CONDITION THAT REQUIRES ILLUMINATION.

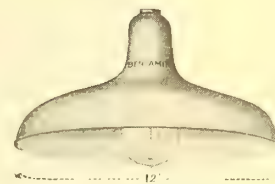
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14-in. to 22-in. sizes. For large or small base lamps



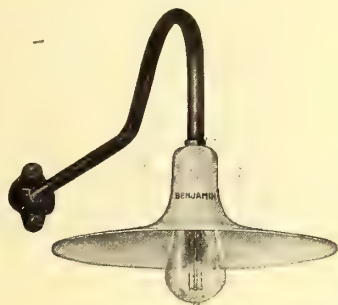
Cat. No. 5421

12-in. to 18-in. sizes. For large or small base lamps



Cat. No. 6166

Deep Bowl Refl. Socket
7-in.—40-60 Watt
9-in.—100-150 Watt
11-in.—250 Watt



Cat. No. 5412

14-in to 20-in Reflectors. For Large or small base lamps



Cat. No. 6162

"ADJUSTOLITE"
Provision made for either extensive or intensive illumination 7-in., 9-in., 11-in.

Write for "Bulletin Illuminating" Cat. C-20.

BENJAMIN ELECTRIC MFG. CO.

64 York St., TORONTO

Prevent Costly Interruptions to Power

By Installing Fuse Protection on Service Wires Outside the Factory.

Type "F F" CONDULET

is a weatherproof, cast-iron fuse box especially designed for this important, but frequently neglected need.

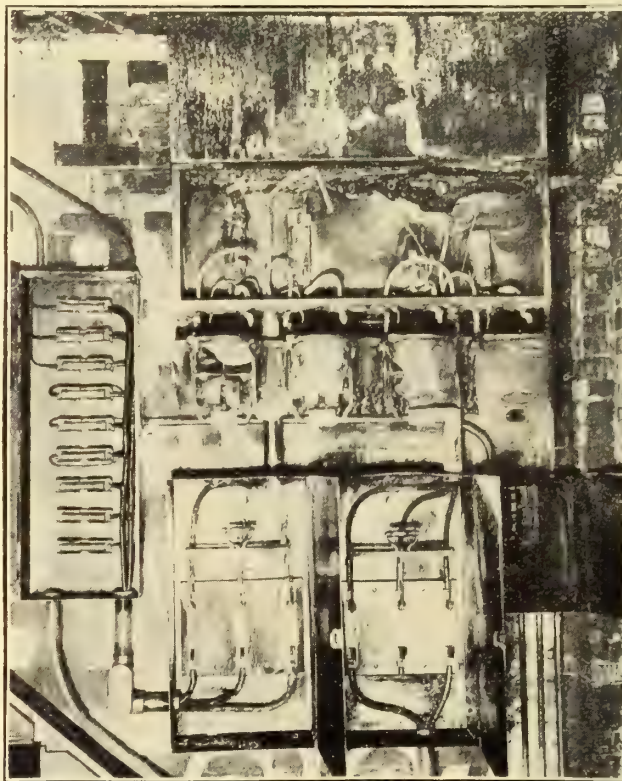
Power companies should gladly cooperate in the installation, as the protection is mutual.



Type "F F" CONDULET

has the indorsement of the National Board of Fire Underwriters.

The burn-out shown below, with its days of lost time, could not have happened if a Condulet of this type had been installed.



Fuses in a type "F F" Condulet would have blown and cut off current, thus preventing burn-out

There's a special Condulet for Each Distinct Exposed Conduit Outlet Requirement. They are all Illustrated and Listed in Condulet Catalog, Bulletin No. 100. Copy Sent Free to any Address upon Request.

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Central Supply Engineers !

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Test our instruments on
LOW LOAD

Samples furnished on request

**The Chamberlain & Hookham
Meter Co., Limited**

(C. & H. Meter Co.)

Kent Building - Toronto

S. L. B. LINES, Managing Director



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Annunciator Wire
 Armature Wire
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 Deck Cable
 Drop Wire
 Electric Heater Cord
 Elevator Cable

Fixture Wire
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 Cable
 Lamp Cord
 Lead Covered Cable
 Magnet Wire
 Marine Wire
 Motor Boat Wire
 Office Wire
 Packinghouse Cord
 Pothead Wire
 Paper Insulated Power
 Cable
 Paper Insulated Telephone
 Cable
 Paper Tape
 Portable Lamp Cord
 Pothead Compound
 Etc. Etc. Etc.

Rubber Covered Wire
 Rubber Covered Cable
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 Slow Burning Wire
 Slow Burning Weather-
 proof Wire
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 Switchboard Cords
 Switchboard Wire
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 Wire

Send for Catalogue or Specifications covering these lines in detail

Imperial Wire & Cable Co. Limited

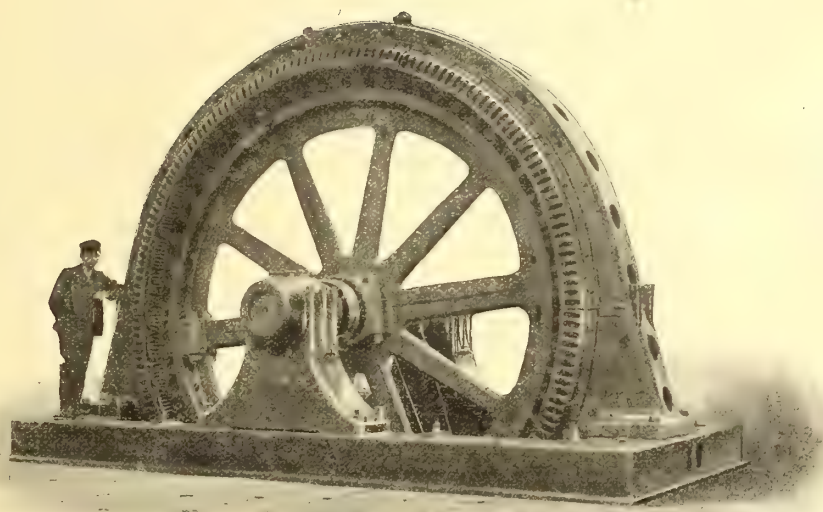
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THE NORTHERN ELECTRIC AND MANUFACTURING COMPANY LIMITED

Sales Agents: Toronto, Winnipeg, Regina, Calgary and Vancouver

Hydro Electric Power Plant

Slow Speed, Horizontal and Vertical Water
Wheel Type Generators a Specialty



1,250 K.W., 120 r.p.m., 2,400 Volts, 3 Phase, 60 Cycle Water Wheel Type Generator
installed 1910 for the Seymour Power and Electric Co., Campbellford, O t.

Kilmer, Pullen & Burnham, LIMITED

Head Office,
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Canadian Carbon Co. Limited

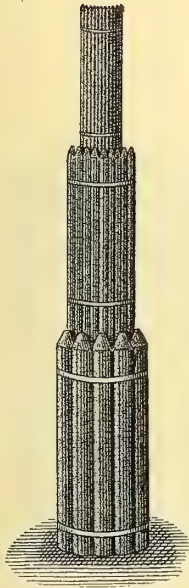
96 King Street W., TORONTO

carry in stock the famous "PLANIA"
Highset Grade Carbons for



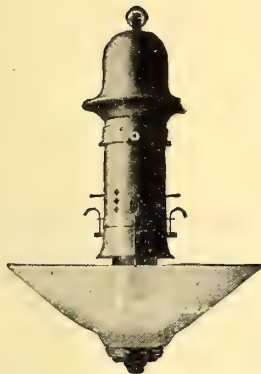
NINE LIVES

FLAME ARC, D.C. or A.C., all colors
ENCLOSED ARC
OPEN ARC
PICTURE MACHINES



Our Carbons are made from special selected coal, which contains less impurities than any other coal in the world, therefore Ash Deposit is practically nil. They give a steady bright light and are perfectly straight. Each carbon is hand gauged, also free from blisters.

SOMETHING ELSE — There is money in our Carbons — ASK US HOW

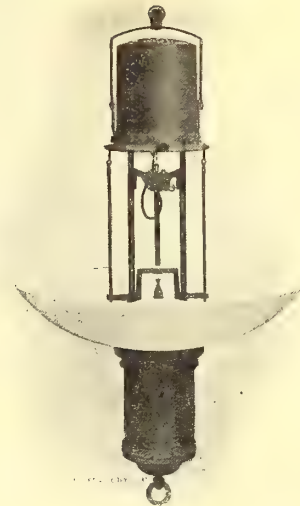


Semi-indirect Lamp
Cover 195



Inverted Lamp
Cover 45

Three Standard Types of Inverted and Semi-
inverted Arc Lamps for lighting interiors
to get "daylight" illumination.



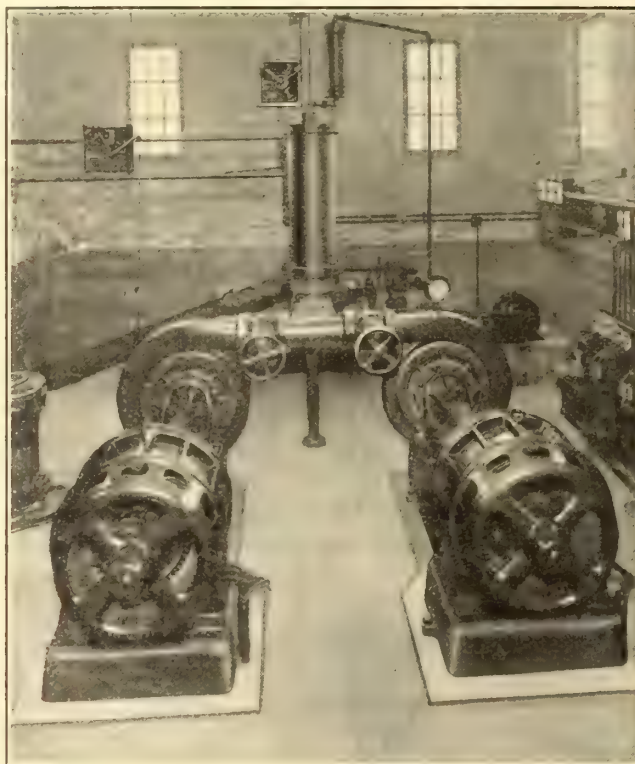
Semi-indirect Lamp Cover 68

CANADIAN UNION
ELECTRIC CO LIMITED

No. 9 St. Nicholas St.,
MONTREAL

CENTRIFUGAL PUMPS

DRIVEN BY
ELECTRIC MOTORS
 FOR
HANDLING SEWAGE



One of the first obvious uses discovered for the centrifugal pump was the handling of water containing foreign elements that would either become lodged in the intricate passages of a reciprocating pump or be caught by the closing valves, allowing the pump to lose its suction. In modern sewage pumping stations, therefore, the centrifugal is preferred, as all foreign matter will readily pass through it.

The Sunnyside Avenue sewage pumping plant of the city of Toronto is unique. The station being small and isolated, as far as similar city equipments

are concerned, the plant was designed to (1) automatically prime its own pumps; (2) to start pumping when the water in the reservoir had risen to within one foot of the pump house floor, and (3) to stop the pumps when the reservoir had been pumped out.

The main equipment consists of two 6-inch special centrifugal sewage pumps, built by us. Each has a capacity of 800 imperial gallons per minute, and is direct connected to a 40 h.p. induction motor. These pumps are started and stopped by Cutler-Hammer relay starters, operated by floats that rise and fall with the level of the water in the reservoir.

For further particulars regarding these pumps see
 Bulletin No. 106

**THE JOHN McDOUGALL
 CALEDONIAN IRON WORKS CO.**

Limited

Works, 512 William Street, Montreal



X CELL DRY BATTERIES

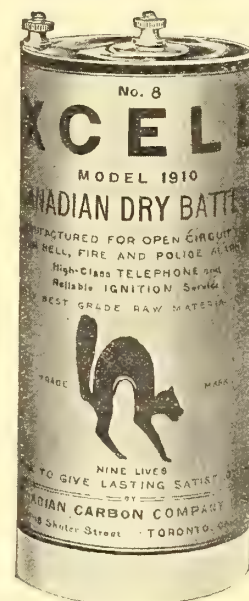
Are Well Known by Most Battery Users Because of Their
Consistent High Quality

These batteries are constructed under a secret process by skilled mechanics and will outlast any other battery on the market—comparison has proven this to be a fact.

X CELL "Nine Lives" batteries WILL NOT POLARIZE RAPIDLY and will RECUPERATE AT REST three-quarters of the current used in service

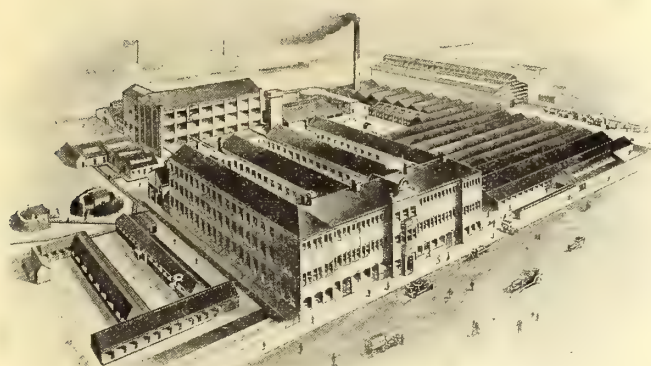
Our long-lived battery has the highest voltage, the lowest internal resistance and recuperative powers that cannot be equalled.

Dealers will procure a good profit on every sale and are protected by our very popular "Nine Lives" trade mark. Do not hesitate—it means good money to you. Get our circulars and prices at once.



Canadian Carbon Co., Limited.

96 King Street W., Toronto



View of Birmingham Works

Manufacturers of:—

A. C. & D. C. Motors and Dynamos
Flame & Enclosed Arc Lamps

L. T., H. T. and E. H. T. Switchgear
Electric Cookers, Heaters and Small Heating Appliances
Electrical Accessories and Porcelain Insulators

Controllers for all classes of service
Small Ventilating Fans

COMPETITIVE PRICES

HIGHEST QUALITY

QUICK DELIVERY

The Electric & Ordnance Accessories Company, Limited

Proprietors: VICKERS Limited

ASTON

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PLEASE ADDRESS ALL ENQUIRIES TO MESSRS. LEWIS BROS., LIMITED, BLEURY STREET, MONTREAL

Public Service Corporations

desiring to finance their needs by the sale of Bonds are requested to communicate with us.

We deal extensively in the bonds of Hydro-Electric Power Companies, Electric Railways, Gas Companies and Electric Lighting Companies which meet our requirements.

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Investment Bonds

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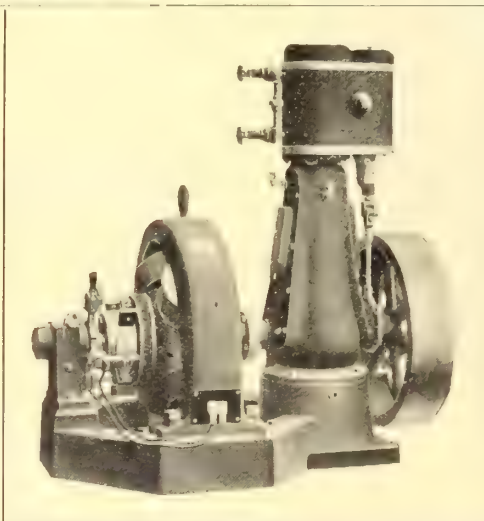
**We Purchase Outright
entire issues of bonds
on steam and elec-
tric railroad, gas,
electric and
hydro-electric
properties**

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Established 1882
Incorporated 1911

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EFFICIENCY



By Efficiency in a Generator we mean one that will give you maximum output for the least expenditure of driving energy.

**Toronto & Hamilton
Electric Company**
Hamilton, Ontario

Paragon Handy Lamp Bracket

It consists of a Lamp, Revolving Shade or Reflector, Silk Covered Coil Spring Hanger and ten feet of Extension Cord.

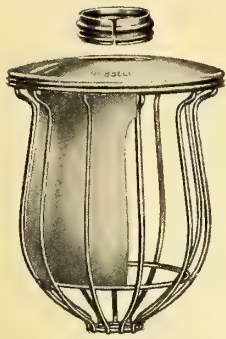
Saves one-third of all Electric Light bills.

Connects to any Electric Light Socket and instantly attaches to any Furniture by Coil Spring.

WRITE TO-DAY FOR PRICES

**Central Electric & School
Supply Co., Limited**

36 Adelaide St. West, Toronto



No. 5766

Lamp Protection and Light Reflection

This combination is of great value in factory service. It can be used to equal advantage on drop lights and fixtures. The Reflector can be turned so as to focus light on any manufacturing operation and the eyes are shielded from glare. The reflector is removable.

Hubbell Reflector Guard

It is held in place by spring projections which snap around the guard wires. This combination enables the use of small lamps in place of large ones thereby effecting a saving on current bills. Dealers write for discounts and free sample.

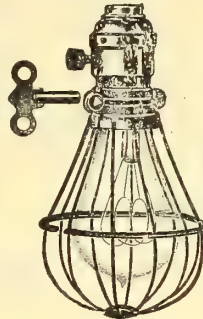
R. E. T. PRINGLE

Montreal

Toronto

Windsor

USER AND DEALER BOTH SAY
McGILL
SAFEGUARDS
PLEASE
AND PAY

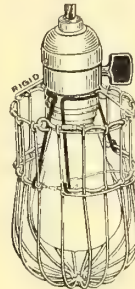


Loxon

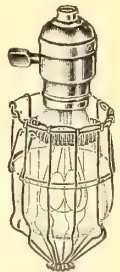


Guard "O"

Are YOU
Using and
Selling Them
?



Guard "H"



Guard "A"

*Write for prices and
Catalogue of full line*

McGILL MFG. CO.
5 OAK ST., VALPARAISO, IND.



Largest Exclusive Electrical Supply House in Western Canada



We Cover NORTHERN ONTARIO, MANITOBA, SASKATCHEWAN and ALBERTA.
Advise us by post card and we will have our traveller personally call on you.

All lines of standard electrical material carried in Winnipeg stock. PROMPT SHIPMENTS,
STANDARD PRICES, COURTEOUS TREATMENT. If you are NOT a customer, you
SHOULD be. It will pay you as well as ourselves.

Write for our new 1912 calendar.

The James Stuart Electric Co.

324 Smith St., Winnipeg, Man. Limited



Sign Receptacles For Electrical Sign Makers

No. 29 is a **self holding** receptacle, strongly made and sheet metal holder. It requires only a plain **round** hole in sign and thus it is more easily and quickly adjusted. Another point is the fact that the making of plain **round** holes is easier on your punches and makes them last longer than if the hole were notched.

No. 988 is a two piece sign receptacle which is now furnished with Mica, insulating point of contact from lamp shells. A thoroughly reliable receptacle of "Duncan Quality."

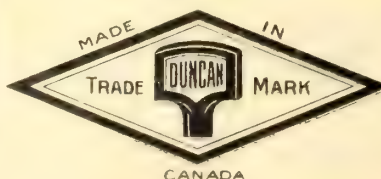
Order from your dealer and if he doesn't stock them write us. Get our new catalog for your file. It shows many electrical supplies, all of "Duncan Quality."

The
**Duncan Electric
Company, Limited**
MONTREAL

Makers of Electrical Supplies
bearing this trade mark.



No. 988



No. 29



The Scoop Reflector

for

Show Window Illumination

When all has been said and done the searchlight principle is pretty hard to beat.

Of course, no man wants a searchlight pointed at him, but our principle of store window lighting is based on having the searchlight trained to bear upon the goods to be shown so that the window becomes a picture with no glare, no distraction.

You can prove this for yourself any time by noticing how much longer spectators will stand before a show window where the lights are hidden from their view as compared to those where the lights are directly in line of vision. Our SCOOP REFLECTORS are nothing less than the absolute perfection of this general method of store window lighting, as they are so constructed as to concentrate and diffuse every bit of the illumination possible and direct it upon the goods displayed.

No Glare. No Irritation.

No Waste of from 30 to 60% of the Light on the Sidewalk, Ends and Top of Window, as is the Case with Practically every other Method.

Leading stores throughout the country are installing either the Scoop, the Helmet or the Poke Bonnet, one of the searchlight type of reflectors best suited for their particular sized windows.

Write us and we will tell you in detail more about this in our free booklet.

EFFICIENT SHOW WINDOW ILLUMINATION

Also send for information on the Eye-Comfort System of Indirect Illumination.

National X-Ray Reflector Co.

214 Jackson Blvd., CHICAGO

READ THIS LETTER CAREFULLY

The writers, The Engineering Supervision Co. of New York, make a business of securing power plant economy for their clients. You can rely upon what they say

"You have asked what your battery did at 471 Park Avenue.

"1. Saved 20 per cent of the fuel during seven months of the year.

"2. Allowed the supply of both light and power from one dynamo, without the slightest flicker in the lights.

"3. The plant was designed for two units instead of three, and the units may be operated at or near rated capacity without any allowance for elevators, as the battery takes the inrush.

"4. Allows shutting down the electric plant after the heavy lighting load goes off, intermittent elevator service and the small amount of lighting being supplied from the battery.

"5. By designing the plant from the start with a battery, the first cost was not increased over a straight engine-dynamo plant more than 10 per cent and the saving is half of this each year. The battery is available in emergency and has been so used to carry elevators and small day lighting loads while work was done on a steam main.



"In our opinion, a battery is as essential in an isolated plant as a feed water heater or a spare unit."

Gould Storage Batteries are backed by indisputable service figures for proof, and can be used profitably in many fields. Ask for literature covering your needs

Gould Storage Battery Co.

General Offices: 341-347 Fifth Ave., NEW YORK

Works: DEPEW, N. Y.

BOSTON, 89 State St. CHICAGO, Rookery Bldg.

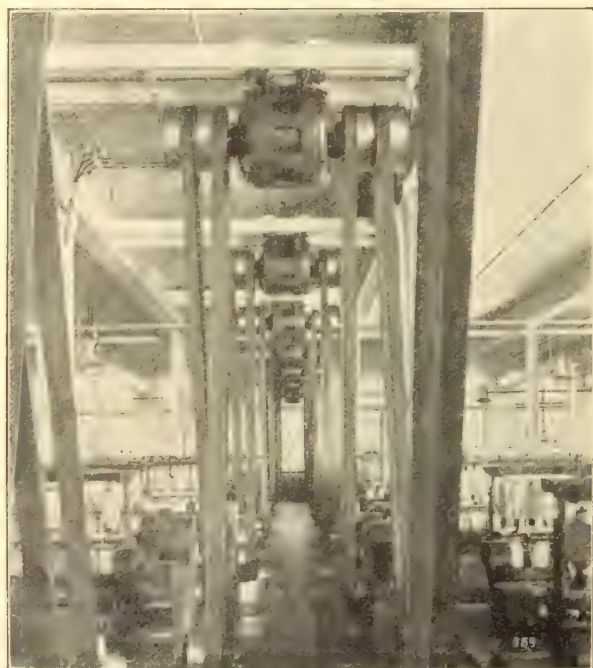
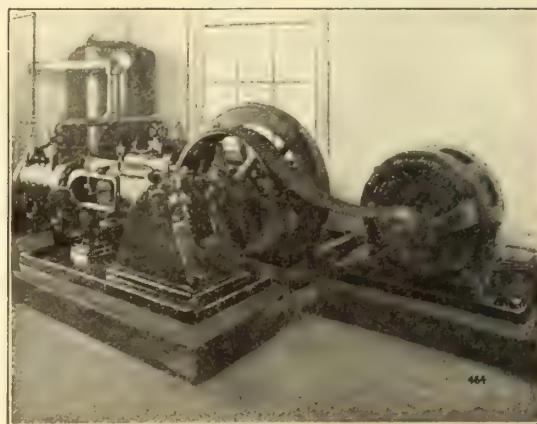
SAN FRANCISCO, Atlas Bldg.

CLEVELAND, American Trust Bldg.



Crocker - Wheeler MOTORS

ARE BUILT
TO STAND UP
AND WORK



UNDER ALL
CONDITIONS

Bulletin 126
tells why

A POST CARD WILL BRING IT.

Canadian Crocker - Wheeler Co.

Manufacturers and Electrical Engineers

LIMITED

HEAD OFFICE AND WORKS: ST. CATHARINES, ONT.

BRANCH OFFICES: MONTREAL, QUE.
VANCOUVER, B.C.



The Labor Cost is the biggest Cost in Conduit Construction

The same workman who carries one section of tile conduit can carry six sections of J-M Fibre Conduit. One laborer can lay 1,000 feet of J-M Fibre Conduit in the same time required for two men to lay the same quantity of tile or stoneware conduit. Therefore you cut your labor cost in half by using J-M Fibre conduit.

You also save in breakage, as the average loss with tile conduit is 5%, and practically nothing with



J-M Fibre Conduit

"The Strongest Conduit Made"

You save in trucking and freight, as J-M Fibre Conduit, weighing only one-sixth as much as tile, costs much less to transport.

One of the largest users of conduit in this country effected

A Saving of 25 per cent.

with an installation of several hundred thousand feet of J-M Fibre Conduit.

Other advantages of using J-M Fibre Conduit for underground wiring are described in an interesting booklet which our nearest branch will send you on request.

The Canadian H. W. Johns-Manville Co. Limited

Manufacturers of Asbestos
and Magnesia Products

ASBESTOS

Asbestos Roofings, Packings,
Electrical Supplies, etc.

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MONTREAL, QUE.

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1397

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St. Lambert, P.Q.

DISTRICT MONTREAL

Phone: Main 3988
Montreal Exchange



500 Amp. 6,000 Volt Automatic
Oil Circuit Breaker Laminated Con-
tacts Individual Oil Tanks. Can be equip-
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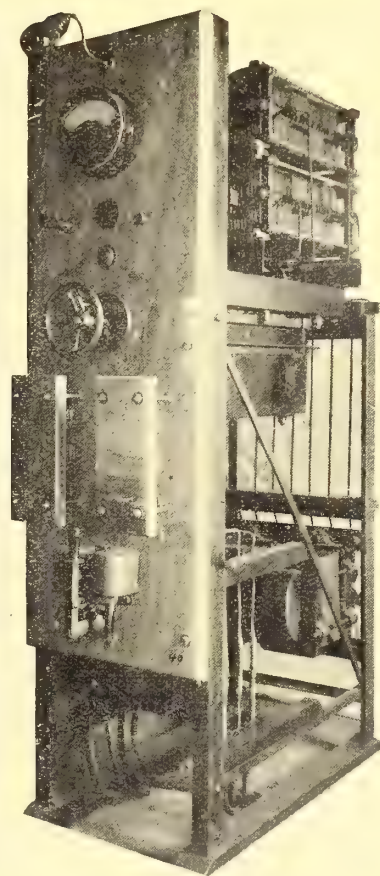
We
manu-
facture

Electrical
Specialties,
Switchboards,
Switches

Special Transformers

and numerous other Electrical Ap-
pliances but space prohibits enlarge-
ing on them in this issue.

300 H.P. 2500 VOLT MOTOR STARTING EQUIPMENT





Western Trade Prefers a Western Made Battery

Western dealers handling Winnipeg-made batteries can be sure of having **absolutely fresh cells** on hand all the time. Our advertising campaign is now in full swing and the demand for

X CELL DRY BATTERIES

is greater than ever.

Order from your Jobber or Write the
Factory direct

Canadian Carbon Company, Limited
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TRADE MARK
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On a Construc-
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Is a Guarantee of the high-
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facilities attain in the manu-
facture of **LINEMEN'S**
tools.

Our Catalogue tells
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It will help to solve
the Spring construc-
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**Oshkosh Mfg.
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Successors to

Oshkosh Logging Tool Co.
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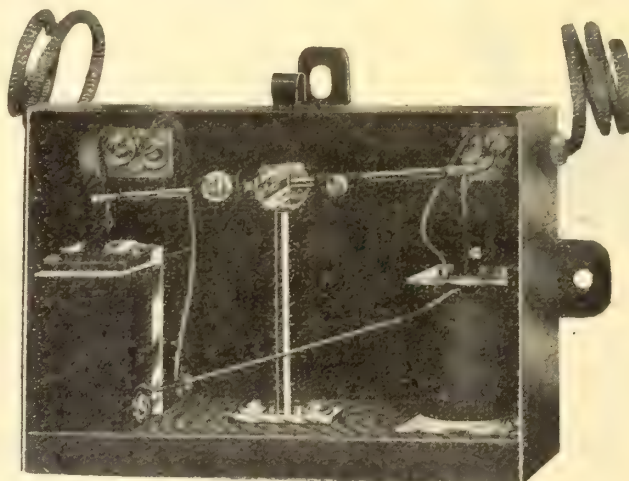
**Oshkosh,
Wisconsin**



Overload Does Not Injure This Controller

THE SHEDRICK ELECTRIC LIGHT CONTROLLER OR LIMITER

Not Made
to
Last a Year
But a
Lifetime.



A
New
Departure
in
Controllers

Result of test of a ten light controller put in circuit with an overload of four lights (fourteen in all) with an average make and break of one hundred and twenty per minute (330,000 strokes)—more than any instrument would be subjected to in a lifetime—showed absolutely no injury in any way to Controller.

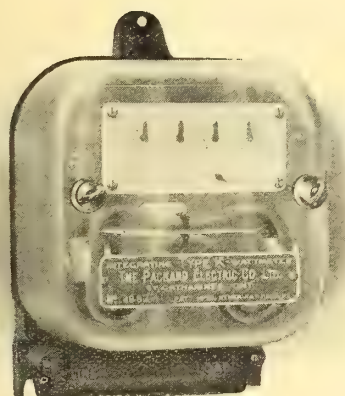
SATISFACTION GUARANTEED—WRITE TO-DAY FOR PRICES

Electric Specialties Manufacturing Company
157 Craig Street West, Montreal

Packard

METERS

Absolutely Reliable



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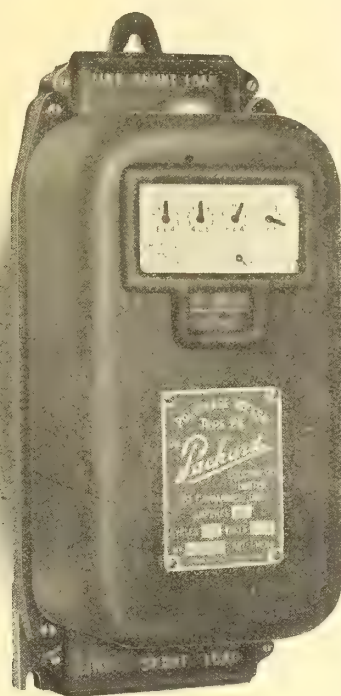
Type
"K"

Perfect Workmanship



TYPE K METAL CASE

Accurate
on
Light
Loads
—
Output
Increased



TYPE PK POLYPHASE

Guaranteed to Meet
the Most Exacting
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Prompt Shipments

Write for New Full Descriptive Bulletin No. 120

The Packard Electric Company, Limited

Factory: ST. CATHARINES


General Sales Office
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Phone M. 1002

N. W. Office and Warehouse
WINNIPEG

"Galvaduct" and "Loricated"

The Conduits that can be Depended
on for Long and Efficient Service



TRADERS
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ANOTHER
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QUALITY AND DURABILITY

are essential features in Conduits. These qualities are found in the highest degree in "GALVADUCT" and "LORICATED".

The work of installing good Conduit costs no more. Besides they eliminate unexpected and often disastrous mishaps.

Always specify the Conduits made by

Conduits Company Limited

Toronto and Montreal

John Starr, Son & Co.

Limited
158 Granville St. - HALIFAX, N. S.

Electric Lighting Supplies

LAMPS, SOCKETS, ROSETTES, WIRES, CORDS,
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OUTS, FIXTURES, ETC., ETC.

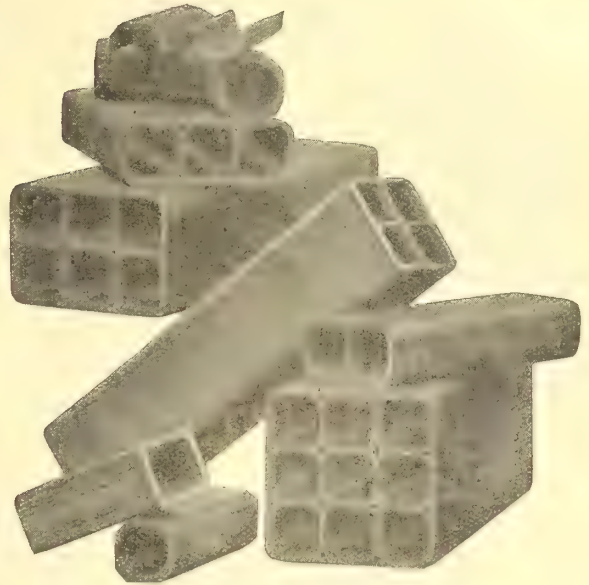
Large Stocks - Prompt Shipments

Write Us for Low Prices

American Sewer Pipe Co.,

AKRON, OHIO.

Vitrified Conduit—Best Made

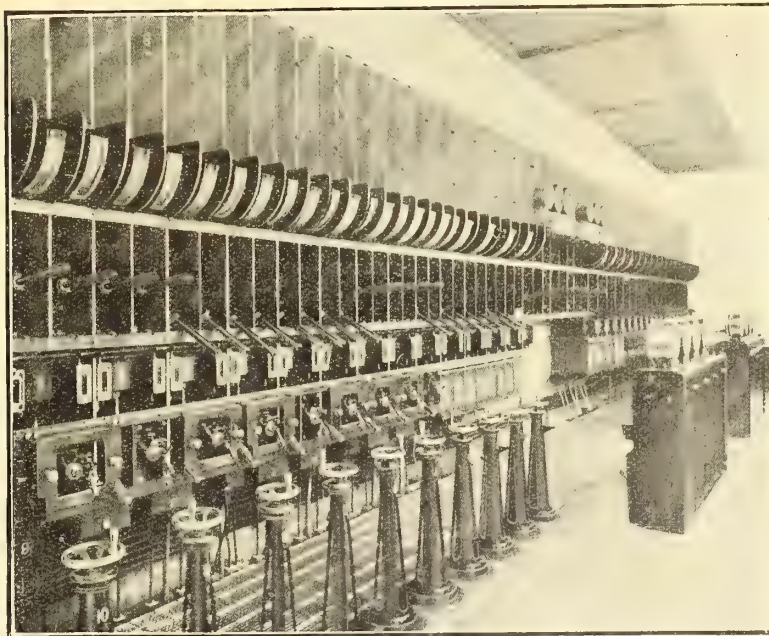


Among our Satisfied Customers are Cities of
Toronto, London, Calgary.
Ask Them.

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ELECTRICAL and
GENERAL ENGINEERS

Manufacturers
of
Complete
Switchboards
D. C. & A. C. up
to 60,000 Volts.
Transformers
Auto Starters
Switches
Circuit
Breakers, etc.



Reliable
Operation

Substantial
Construction

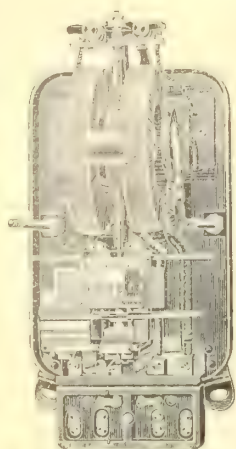
combined with

Accuracy
and
High Class
Finish

Canadian Representative — **G. C. ROYCE** — West Toronto, Ontario.

If you are in the market for any kind of electrical equipment—send us your specifications and let us quote you.

WATTMETERS

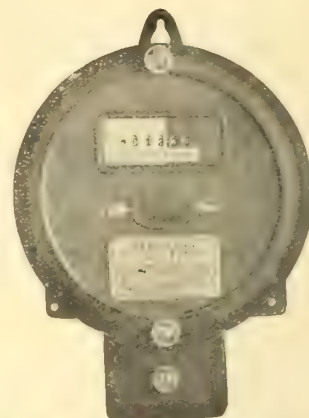


D. C. Bergmann Wattmeter

We have closed contracts for over 1,500 wattmeters, the larger portion for use on Hydro Electric Commission Lines.

Our prices, like our meters, are right.

We will gladly send sample meter to any recognized company for approval.



A. C. Bergmann Wattmeter

Chapman & Walker, Limited

Head Office : 69 Victoria Street, TORONTO, ONT.

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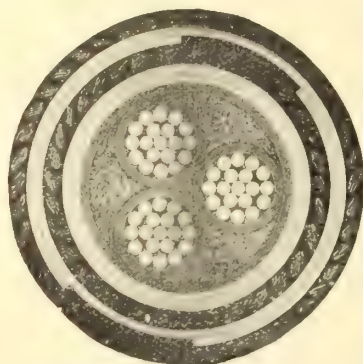
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V. I. R. Cables

Wire, Flexible

Paper Insulated
Lead Covered
Cables

Telephone Cables



.075 sq. in. three core, circular
lead covered, steel tape
armoured cable

MONTREAL AGENTS:

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Montreal, Que.

Vulcanized Bitumen Cables

Transmission
Lines

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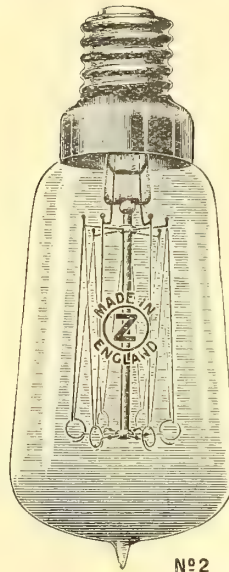
W. T. Henley's Telegraph Works Co. Limited

Contracts taken for complete Cable Systems installed

"Z" LAMPS



No 1



No 2



No 7

One of the greatest troubles with Tungsten Filament Lamps, a black deposit on the glass, has been successfully overcome in "Z" **Tungstens** by coating the stem of the lamps with **Phospham** which chemically absorbs the black deposit given off by the filament, thus keeping the bulb as clear as a new lamp. All "Z" lamps are fitted with **Standard Vitrite Insulate Bases**.

We have always in stock or on transit over 100,000 Carbon and Tungsten Lamps, which insures prompt delivery the same day as order is received.

Chapman & Walker

ENGINEERS AND CONTRACTORS

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MONTREAL, QUE.
Branch Office
406-407 St. Nicholas Bldg.

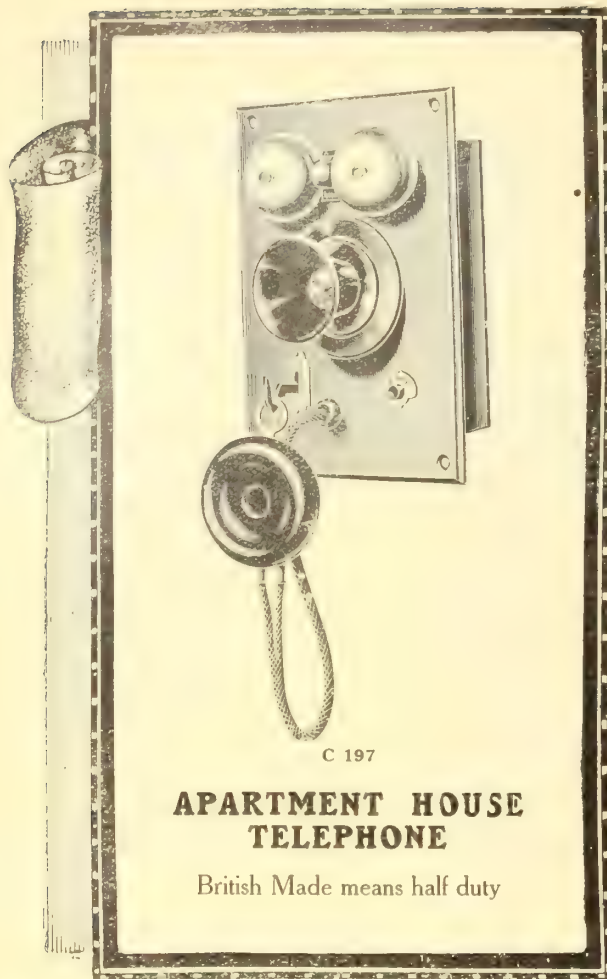
WINNIPEG
150 Princess St.

VANCOUVER
Branch Office
Imperial Block

CALGARY
General Supplies, Ltd.
1233 Second St., E.

PORCUPINE
J. P. Bartleman

Stock Carried in Montreal, Toronto, Winnipeg, Calgary and Vancouver



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British Made means half duty

STERLING TELEPHONES BRITISH MADE

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SASKATCHEWAN:—Northwestern Electric, Ltd.,
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BRITISH COLUMBIA:—Walker & Ure, 527 Duns-
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Mechanics Supply Co., St. Paul, Que-
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“The Ides of March” Bring STORMS AND LINE TROUBLES ARE YOU PREPARED?



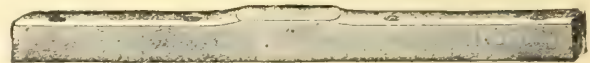
The storm that plays havoc with your pole lines makes you need construction material in a hurry.

We carry large stocks of the following material at all of our houses :

POLES
CROSS-ARMS
TOP PINS AND BRACKETS
INSULATORS, PORCELAIN AND GLASS
CROSS-ARM BRACES
MACHINE BOLTS
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GUY ANCHORS
GUY CLAMPS
POLE STEPS

and in fact all material for the Construction and Main-
tenance of pole lines.



Place your orders in advance and **BE PREPARED FOR EMERGENCIES.** Write for a copy of our Bulletin 2031 to-day

THE *Northern Electric*
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Manufacturers and Distributors of Telephone Apparatus, Electrical
Supplies, and Fire Alarm Apparatus for every possible need.

MONTREAL TORONTO WINNIPEG REGINA CALGARY VANCOUVER



These Trade-Marks Denote Established Standards of Quality

CONDIT

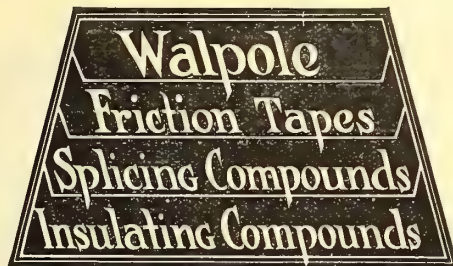
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T. & B.

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Bell Battery



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Quality

Each Trade-
Mark is Your
Guarantee of
Quality and
Economy

Service

The Large As-
sorted Stocks
in Our Houses
Allow Imme-
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ment On All
Standard Ma-
terial

HOLOPHANE



THE *Northern Electric*
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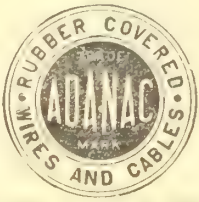
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Regina

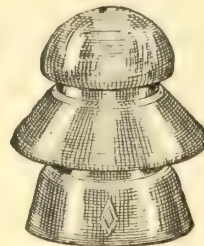
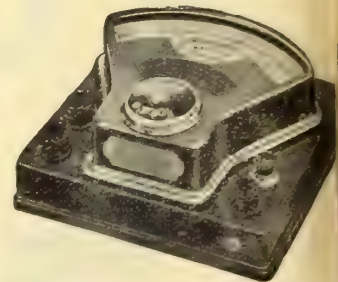
Calgary

Vancouver

THESE TRADE ESTABLISHED STA



THE WIRE & CABLE COMPANY

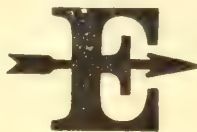
CANADA
DUNCAN SOCKETS AND CUTOUTSDIAMOND GLASS
INSULATORSWESTON ELECTRICAL MEASU
ING INSTRUMENTS

DRY BATTERIES

“Chloride
Accumulator”

REGISTERED SEPTEMBER 11, 1894

STORAGE BATTERY

ARROW ELECTRIC
SWITCHES

HUBBELL SPECIALTIES

“Exide”

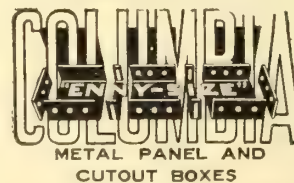
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Guarantee of
Quality and
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(Reg. U. S. Pat. Off.)

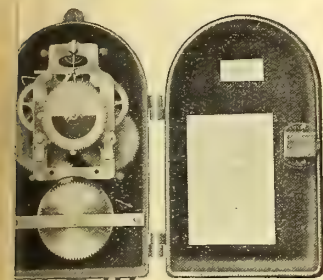
LORICATED AND
GALVADUCT CONDUITSKELETON AND ENCLOSED
SIGNAL BELLS

THE *Northern*
AND MANUFACT

MONTREAL TORONTO WINNIPEG

ADDRESS 0

MARKS DENOTE STANDARDS OF QUALITY



HARTFORD TIME SWITCHES

WARD LEONARD

RHEOSTATS AND CONTROLLERS

SERVICE

Large As-
orted Stocks
Our Houses,
low Immed-
te Shipment
all Standard
Material



BROOKFIELD
STANDARD GLASS
INSULATORS



EDWARDS & CO., INC., HOUSE GOODS



IMPERIAL WIRE & CABLE CO
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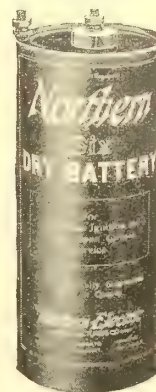
"D & W" FUSES AND
CUTOUTS



P. & B. INSULATING
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CROUSE-HINDS
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PANEL BOARDS



NORTHERN SIX
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MAZDA
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HIGH AND LOW VOLTAGE
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(Reg. U. S. Pat. Off.)

Electric

RING CO. LIMITED



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We have been appointed Agents for the Weston Electrical Instrument Company

Weston electrical measuring instruments have no competitors. They lead ; others follow. Weston quality is a standard which may be approached but not surpassed.

Information on this line can be furnished by any of our houses who can make satisfactory deliveries on all of your orders.

Write our nearest house for copy of Bulletin No. 2033.

THE *Northern Electric*
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Manufacturer and Distributor of Telephone Apparatus, Electrical Supplies, and Fire Alarm Apparatus for every possible need.



Montreal

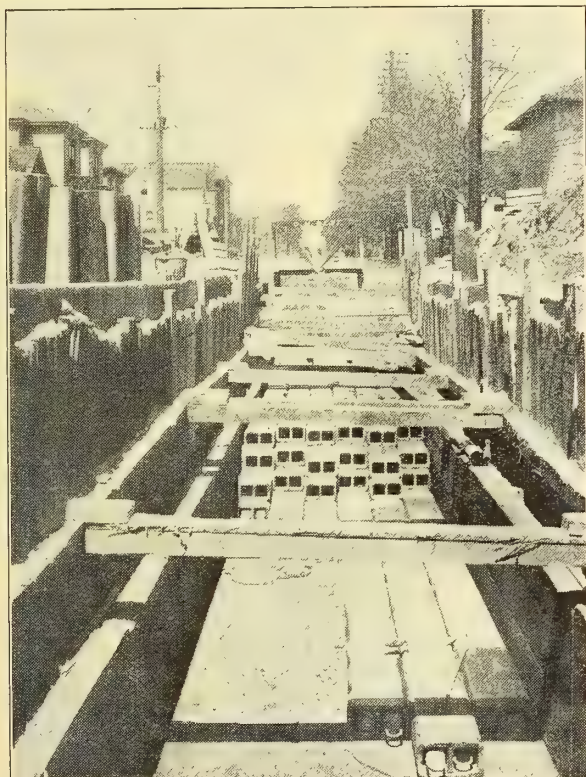
Toronto

Winnipeg

Regina

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Vancouver

G. M. GEST**Conduit Engineer
and Contractor**

Electrical Underground Conduit Systems

When **G. M. GEST** designs and constructs your Conduit System you receive the benefit of many years' experience and specializing in that line of work.

Power Building, Montreal, P.Q.



BY the time these lines reach your eye we will have ready for distribution a HANDBOOK of the I-T-E CIRCUIT BREAKER. This is a combined TEXTBOOK on the use of circuit breakers and a PRICE LIST of our product which should be in the library of every Consulting and Operating Engineer.

We have been at work on this publication for more than two years, and have spared no pains or expense to make this work so authoritative that it will occupy the same position as a textbook that the I-T-E CIRCUIT BREAKER does in the electrical installation, the last word on the subject of protection.

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The Cutter Company, 751 Ellicott Square, Buffalo, N.Y.

Eccles & Smith Co., 524 S. Los Angeles St., Los Angeles, Cal.

Electric Manufacturers' Sales Company, Denver, Colo.

The Cutter Company, 1555 Monadnock Block, Chicago, Ill.

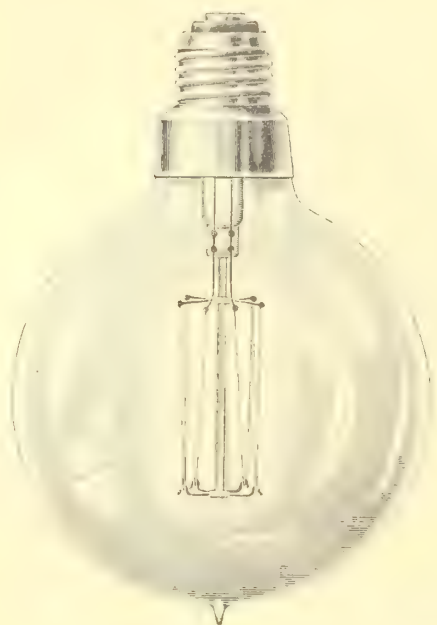
The Cutter Company, 1418 Ford Building, Detroit, Mich.

Eccles & Smith Co., 71 First Street, San Francisco, Cal.

Eccles & Smith Co., 68 First Street, Portland, Ore.

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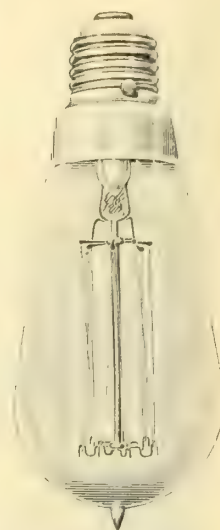
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AND
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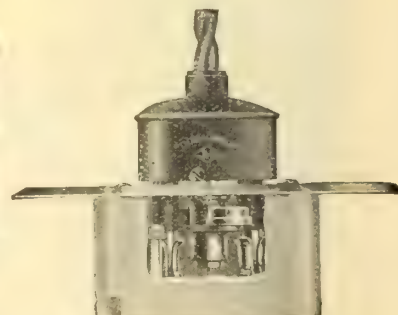
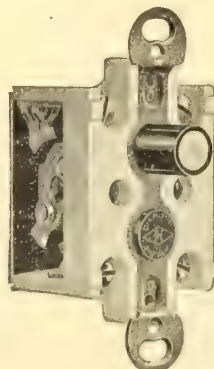
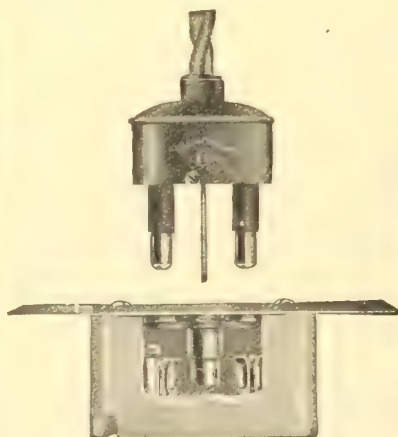
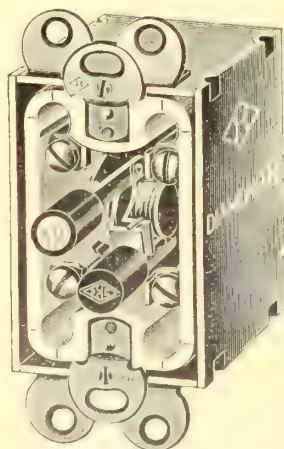
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The best protection for the user because they are dependable in operation. The safest investment for the dealer, engineer or contractor because they give satisfaction.



The "Diamond H" on a switch is valuable insurance—assurance that quality, materials and competent workmanship are embodied to perfect production.

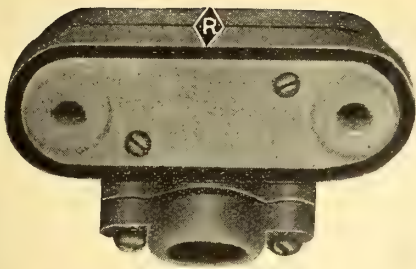


MANUFACTURED BY THE HART MANUFACTURING CO., HARTFORD, CONN.

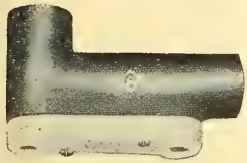
Canadian Sales Agent:

C. W. Bongard, Toronto, Canada

CONDUIT FITTINGS



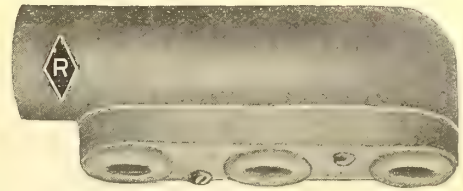
F 1/2"-2 Wire Cover



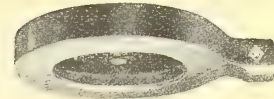
L B 1/2"-2 Wire Cover



A 1/2"-3 Wire Cover



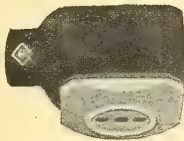
E 1/2"-3 Wire Cover



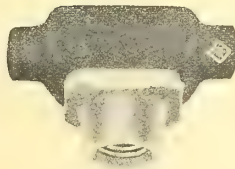
P 1/2"



1445-Reversible Guard



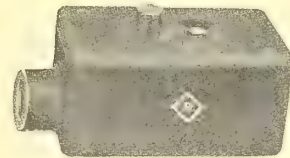
K 1/2" Plug



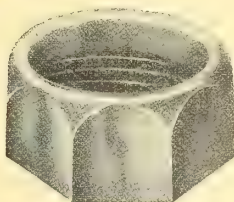
J 1/2" Receptacle



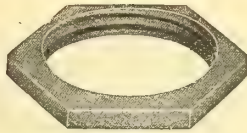
3/8" Fixture Stud



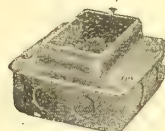
F D 1/4" Push Switch



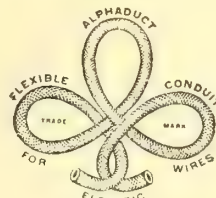
1/2" Bushing



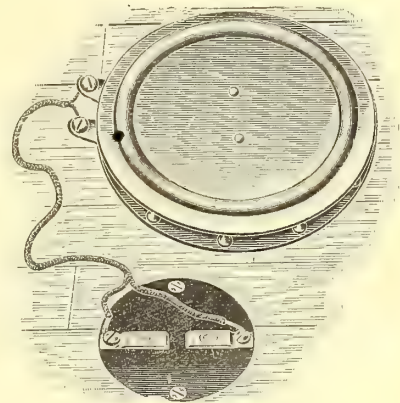
1/2" Locknut



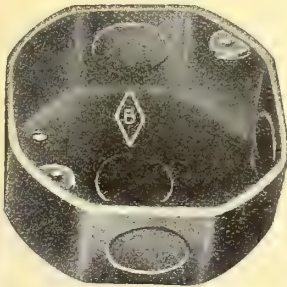
1915-Switch Box



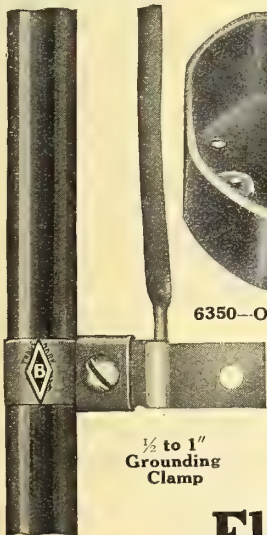
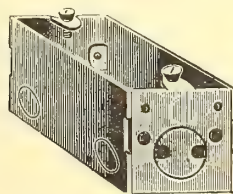
Alphaduct 1/4"



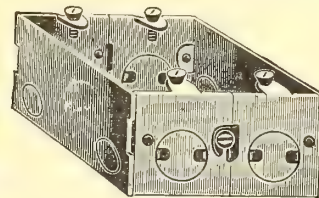
150-Floor Tread



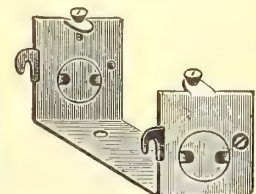
6350-Outlet or Junction Box

1/2 to 1"
Grounding
Clamp

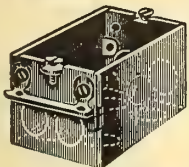
170-Comb Switch Box



172-2 Gang



171-Spacer



C C S. I. Switch Box

Electrical Fittings Co. Limited

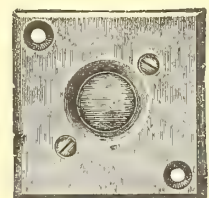
70 King Street West, TORONTO, Canada

British Columbia Agents, Cope & Son Ltd., 132 Water St., Vancouver, B. C.

Quebec City Agents, Mechanics Supply Co., Ltd., 80-90 St. Paul St., Quebec, Que.

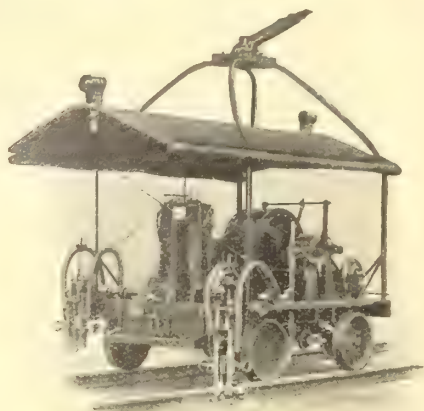
"Made in Canada"

Write for Catalogue No. 3. If your Jobber cannot supply, write us.



2685-Pearl Push

Electric Weld Rail Bonds



The conductivity of Bonds installed by our process can never be impaired by moisture or corrosion.

When once installed, they are on to stay and cannot be removed without actual mutilation and considerable hard work.

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The

Electric Railway Improvement Co.

Office and Works, 6005 Carnegie Avenue
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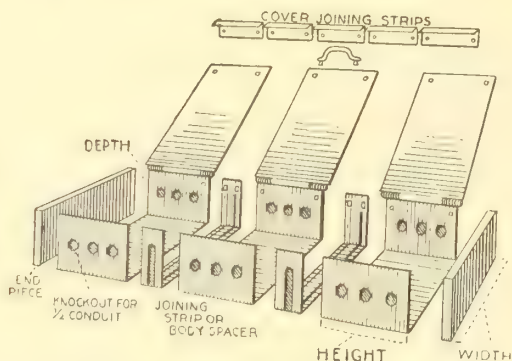
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"BRAIDUCT," the flexible conduit that was built in anticipation of the rigid demands, that, ultimately would be required of this class of electrical protection, and consequently, to-day it stands at the head of the list in quality; ease and economy of installations; as every foot is finished at the factory so there is no waste of time or material on the job. The larger sizes are also the acme of perfection. Ask for samples.

"BRAIDUCT" is approved by the National Board of Fire Underwriters.

The Flexible Conduit Co., Limited
Guelph, Canada

COLUMBIA BOXES



With this system of "Enny-Size" box it is unnecessary to keep a large stock of various sized boxes. Just keep a small supply of "Enny-Size" parts and make up your different sizes as you require them.

Columbia Metal Box Co.

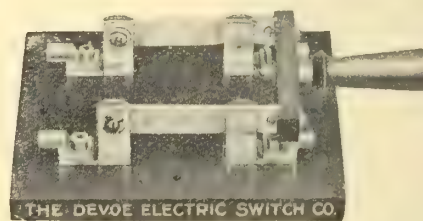
Northern Electric Manufacturing Co. Ltd.
Distributing Agents for Canada

DEVOE

The constant increasing sales of the Devoe Switches is a proof that they are giving satisfaction. If you are not using Devoe Switches begin at once. All our Switches from 25 to 200 ampere are neatly packed in Cardboard Boxes and the others are well parcelled and labelled ready for shipping.



Catalogue No. 2144, fused on Hinge End



Catalogue No. 313

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SOME FRANK CHAPTERS

Insulator "Efficiency"

High voltage line insulators are merely special resistances.

A large number of the foremost physicists of our own and other countries are industriously and intelligently seeking the essence of conductivity or insulation—just now driving hard on the ion theory—and since you of course are following the matter, little do we wonder that you are puzzled to know whether our friend the salesman in his discourse is ignoring or vying with the master minds.

Since no one really knows the *modus operandi* it follows that insulation materials and design are highly empirical and that the fifteen years manufacturing and operating experience back of the "Victor" insulators means the **safest possible** transmission line.

THE LOCKE INSULATOR MFG. CO., Victor, N.Y.

OR

Engineering Equipment & Supply Company

410 St. James Street,

MONTREAL, QUE.



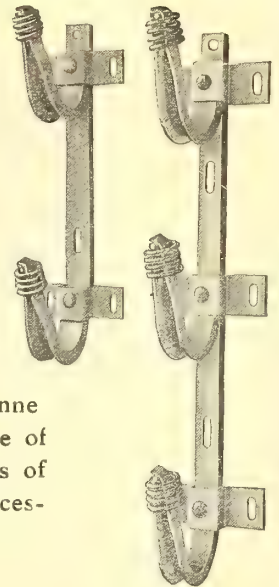
Peirce Brackets

These Service Wire Brackets are saving much in first cost and future up-keep for the Central Stations of the United States and Canada. Toronto and Winnipeg use them exclusively. Forty other Canadian Cities and over four hundred of the principal cities of the United States do likewise.

Peirce Brackets cost more in your warehouse but less on your patrons' buildings than other brackets. They are hot galvanized and made of hot rolled channel steel. The insulator springs are resilient spiral springs, which prevent the breakage of insulators. They allow for the inequalities of insulator bores. This resilient thread is of especial importance in Northern latitudes where wide ranges of temperature cause excessive expansion and contraction of cast iron brackets.

Our Catalogue Lists Sixty Different Styles

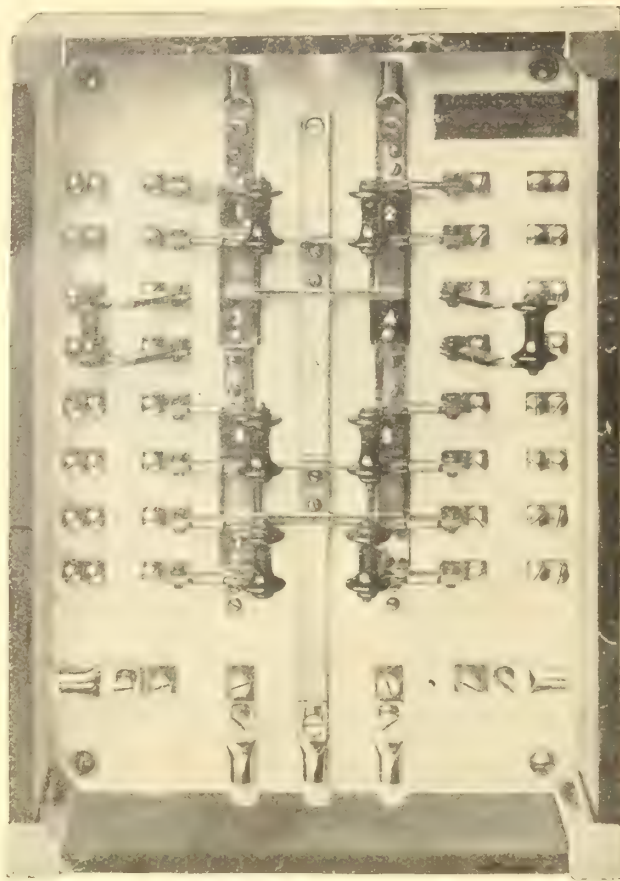
May we send you circulars showing why these brackets cost you less put up than unsightly cast iron brackets?



HUBBARD & CO.
PITTSBURGH, PA.

The World's largest manufacturers of Pole Line Hardware





KRANTZ

Switch Boards and Panel Boards

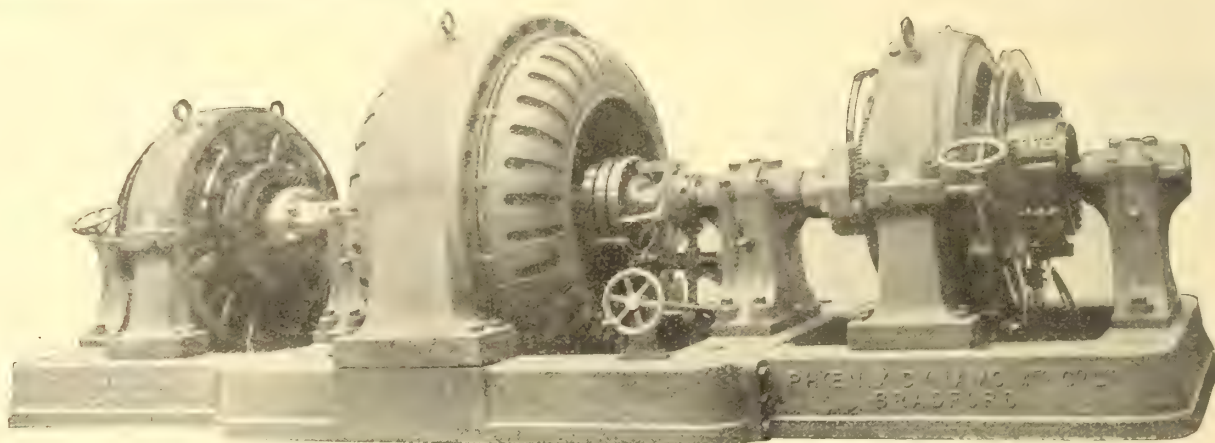
Are the make used in many of the largest institutions, office and government buildings in the United States and Canada.

The main switchboard of the New York Central is a Krantz.

WHY?

because they are the recognised leaders.

Send us your enquiries.



Heavy Current Boosters and Low Voltage Dynamos. Fitted with "Half Turn" winding. Sparkless on 50% Overload, ordinary Carbon Brushes.

The Phoenix Dynamo Manufacturing Co. Limited - Bradford, England

BRANCHES: London, Glasgow, Swansea, Birmingham, Newcastle, Australia, Russia, Japan, Canada.

A LONG STANDING PROBLEM

The attention of Electrical Designers has for many years been focussed upon the production of a really satisfactory heavy current low voltage dynamo which should be free from electrical and mechanical troubles. The users of this type of machine in the past are, unfortunately, well acquainted with the constant trouble—due to the rapid wear of the brushes, overheating and blackening of commutators, sparking and flashing over with sudden overloads. The experienced station engineer is refusing, with growing conviction, the offer of a standard interpole machine with merely an "overgrown" commutator as a solution of this problem.

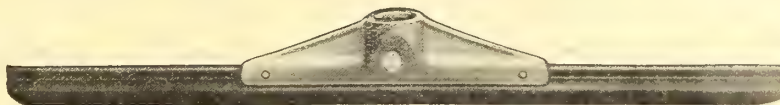
The successful heavy current Booster is a new class of machine, requiring new principles in its electrical and mechanical design. We claim to have solved this problem by means of our "Half-Turn" winding and the accompanying mechanical design of armature and commutator.

WRITE US FOR BULLETIN,

Canadian Agents, **The C. H. Keeler Co. Limited, Toronto, Ontario**

The O-B Extruded Trolley Ear

The results obtained with this Ear in service, indicate that its use will greatly reduce your ear maintenance expense.



O-B Extruded Trolley Ear—U. S. Patent Applied for.

□ It consists of an Extruded Metal runner piece on which is compressed and riveted a malleable iron boss.

□ By a new and superior process, heated bronze is forced through dies under hydraulic pressure and causes the resultant metal to possess great density, absolute accuracy of all dimensions, freedom from all imperfections and great ductility.

□ These characteristics insure long life (equal to about two cast ears), perfect fit on wire, straight under-run, less wear to trolley wheel and great ease of installation. Malleable iron boss eliminates stripping of threads.

□ The sooner you find out about it the quicker will you be able to reduce your ear expense. A request will bring full information.

The Ohio Brass Co., Mansfield, Ohio, U.S.A.

Heating With Exhaust Steam

The Most Profitable Load An Engine Carries

Many of you are manufacturing heat in the form of steam, but what becomes of it? You are simply converting 10 to 14 per cent. of it into mechanical energy in the form of electricity, and throwing the balance away, either into the atmosphere or into the condenser. The plant which operates non-condensing may have 10 per cent. heat efficiency and the condensing plant a possible 14 per cent. conversion.

Why Not Sell the Larger Amount of the Otherwise Lost Energy

You can get a price for it which will pay the total fuel bill of the plant, including also such other expenses as water, oil, etc.

CAN IT BE DONE? YES!

Others are not only doing that very thing, but are also earning interest and depreciation on the cost of the steam installation.

*We not only Make Reports and Build Central Station Plants,
but Solicit Business and Manage Such Plants, if Required.*

Why Not Take Advantage of Our Experience?

Central Station Heating & Construction Co.

714 Ellicott Square, BUFFALO, N. Y.

Canadian Office W. E. SKINNER LIMITED, Somerset Building; WINNIPEG

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For All Purposes

Bare Copper and Aluminium Wires
and Cables.

Slowburning Weatherproof Wires; also
Weatherproof Slowburning Wires.

Office Wire, including Dampproof
Office Wire.

Weatherproof Insulated Copper, Iron
and Aluminium.

Rubber Covered Wires and Cables.

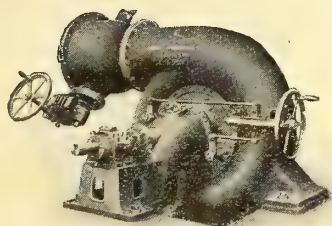
Galvanized Telegraph and Telephone
Wire.

Galvanized Steel Strand for Guys.

Canada Wire & Cable Co.

Factory and Head Office, 1170 Dundas Street, ^{Limited}
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Water Power Plant



Type 30 Francis Turbine
1000 B.H.P. 120 Feet Fall

Pipe Lines, Governors, etc.

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Messrs. Buyers in General,
ANYWHERE,
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Gentlemen:—

Are you aware that we stock sheet Fibre in sizes from .010 in to 1 in. and can fill your orders same day received for Fibres, Press-board, Leatheroid, Oiled Cambrics, Armature Tapes, Sterling Insulating Varnish, both Baking and Air Drying, besides, of course, a full line of Overhead Line Construction, Car Equipment, Building Wiring Supplies of all descriptions.

Your enquiries and orders entrusted to us will be subject to prompt and careful attention.

Yours to command,

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P.S.—We strive to make each and every sale its own advertisement for further business. Does that appeal to you, SIR?

WESTERN BRANCH:

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Bakelite

Impregnated Wood

WOOD, particularly porous woods such as poplar, basswood and maple, can be so impregnated with the famous product BAKELITE as to be rendered hard and resistant to chemical and physical influence.

BAKELITE impregnated wood has an exceedingly high uniform dielectric strength, this being produced through the well known insulating properties of BAKELITE.

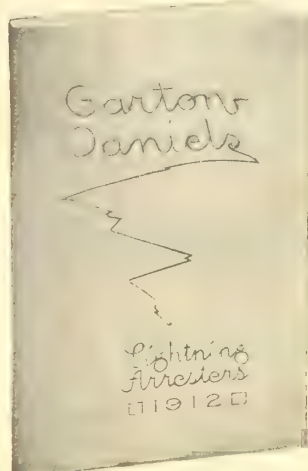
The importance of this for use on high-tension lines and throughout electrical work in general is great as the strength of wood, thus treated is increased and becomes an excellent insulator of electricity, withstands moisture, chemical, solvents and is rot-proof. Where such wood has to be imbedded in cement or other conditions under which it is liable to attack from dry-rot, the advantages of the bakelized product are plain.

Afterwards if desired a beautiful high finish can be obtained with Bakelite Varnish, which resists the same actions as already mentioned.

We will give full information upon request of the many valuable uses to which bakelized wood can be put in electrical work. Write us.

Plastics Limited
Van Horne Street, Toronto

This Book Tells You About Lightning Protection



It tells you in the most concise manner how best to protect any class or kind of electric circuit from lightning, either D.C., A.C. or Arc.

It gives you valuable and up-to-date information about lightning in general; installation of lightning arresters; grounding; distribution; inspection.

It tells you and shows by means of many new cuts, why the small air gap, the low series resistance and the circuit breaker used in conjunction only on the Garton-Daniels Lightning Arrester, makes this arrester

"The Complete Arrester"

and why it will give the man who uses them, complete lightning protection.

And there are eight pages devoted exclusively to diagrams, etc., showing exactly what type of lightning arrester is best suited to any circuit you may have, either D.C., A.C., or Arc. Wouldn't all this information be of extreme value to you?

Ask us for a copy of this book now. It can't help but be of the greatest assistance to you in your work.

Garton-Daniels Lightning Arresters are carried in stock in Canada by John Millen & Son, Montreal, Toronto, Winnipeg and Vancouver. Prompt shipment can be made by them of all standard types.

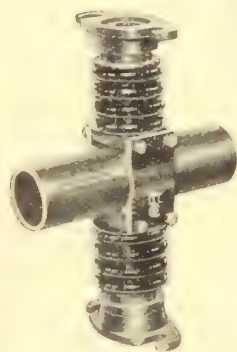
ELECTRIC SERVICE SUPPLIES Co.

Railway Material and Electrical Supplies

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GUARANTEED FOR 5 YEARS!

ALL CABLE END BELLS

CABLE TERMINALS

(WET TEST
2 1/2 TIMES)

(74 Types)

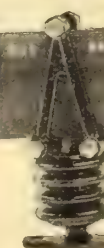
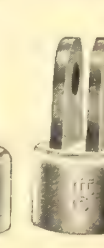
CABLE POTHEADS

Equipped with Patent Ground Clamp Device. No expensive wiping of joints. Will eliminate all break downs and outages. Can ship from stock. Send for Catalogues. All bells shipped with filling compound. Bus bar supports for all voltages for round or flat bus. Malleable pins, wall tubes, roof bushings, air and floor boxes. Malleable switchboard and pipe frame fittings. NOTICE—We own Canadian Patents No. 126336 and No. 131114 covering all applications of cable bells or potheads.

ELECTRICAL ENGINEERS EQUIPMENT CO.

POWER HOUSE SPECIALISTS.

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Electrical News

Generation Transmission and Application of Electricity

PUBLISHED MONTHLY BY

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HUGH C. MacLEAN, Winnipeg, President.

THOMAS S. YOUNG, General Manager.

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Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Correspondence is invited upon all topics coming legitimately within the scope of this journal. Subscribers can materially assist by sending in news items and information regarding electrical development in all parts of Canada.

Vol. 21

Toronto, March, 1912

No. 3

Conserve Our Water Powers

It is of vital importance that every Canadian should be in touch with the situation, as it is now developing, in connection with the disposal, for power purposes, of the waterfalls along the International boundary separating Canada and the United States. The time is fast approaching when Canada will need every available horsepower that legitimately belongs to her along this line. Electric energy, which to-day means light for the few and power for a still smaller number, to-morrow will mean light for everybody; power for the city, town, village and farm; heat to supply our natural lack of coal. On her waterpowers more than on any of her other resources, Canada's future industrial development and supremacy depends, and Canadians are mad if they allow one single unit more of electrical energy to slip through their fingers to enrich and advance the industries of our neighbors to the south. We repeat again, every single available horsepower to which we can legally lay claim will be demanded within the next quarter of a century by the inevitable flood of commercial and industrial development of Canada which nothing but the lack of power can stay.

At the present moment powerful United States interests are at work at two points with a view to further encroachments on Canadian rights. First, at Niagara, where efforts are now being made, simultaneously with the lapsing of the Burton Act,* to obtain the consent of the United

States government to allow a larger amount of power to be exported from the Canadian side. Second, at the Long Sault, where the success of their scheme is considered of such importance by certain U. S. financial interests that they were reported, when they made their last attempt to secure the Long Sault water rights, to have been willing to spend a million dollars in Ottawa to gain their purpose. We mention this latter fact chiefly to indicate the high value placed by these men on Canada's resources, and their determination to secure them for the United States at any price.

That the possibilities of Niagara Falls have been deliberately and ridiculously overestimated is clearly set forth in the recent report of the Commission of Conservation on the Waterpowers of Canada. Extracts dealing with the Niagara situation as prepared for the Commission by Arthur V. White, M.E., are reprinted from this report on another page of this issue. Inasmuch as the figures there given indicate a most careful and accurate study of existent conditions, we ask every Electrical News reader to give them close attention. It is not reasonable that our politicians should fully understand, or appreciate the situation, if electrical men are apathetic. This is a national, not a party, question, and every Canadian citizen associated in any way with electrical operations should see not only that he himself is alive to the facts, but that every voter with whom he comes in contact should become informed on the tremendous issues at stake, and then exert his influence on behalf of conserving the benefits which legitimately appertain to Canada's equity in International waters.

While it is not possible to satisfactorily summarize the extracts quoted elsewhere, yet, there are a few points which stand out prominently in the discussion, and which are given below, not so much as a review of the conditions as to call attention to a number of ideas that should be kept prominently in mind while studying the extracts themselves:

1. Many statements of a misleading character have been made and published by power companies, and others, when applying for water concessions from the government.
2. Natural conditions may already have been unduly and adversely affected. The requirements necessary to keep the river free of ice cannot be reliably calculated.
3. Nearly one half of Canada's share under present modes of development, is already apportioned. More than two-thirds of the power already generated is now being exported to the United States.
4. Canada, in the near future, will need every unit of her share, to supply her own light, heat and power needs.

The contention, or defence, that we should raise no objection to the United States using our power until such time as we require it ourselves, is not worth the time it takes to say it, for the double reason that, first, industrial development follows, but rarely precedes, power development, and second, any attempt to recall power that has already been used to develop industries in the States, would cripple these industries, and, in spite of any possible prior agreement to the contrary, would be sure to meet with the determined resistance of the wealthy vested interests involved. Such interests might even not hesitate to precipitate international difficulties in order to gain their ends.

Since the above was written the Montreal Board of Trade has passed a strong resolution along very similar lines and it is evident that the public men of Montreal are keenly alive to the dangers threatening them and the rest of

*At the present time government provision is only made for the importation into the United States of 160,000 h.p. It is significant to note that the Canadian Niagara Companies petitioned as far back as 1907 to take 282,000 h.p. into the States. See Water Powers of Canada, (Commission of Conservation) p. 65, note.

Canada. The resolution, as proposed by Mr. L. L. Henderson, is as follows:—

"That this Board views with alarm the exploiting by corporations or individuals of the waters of the St. Lawrence for power purposes, and that in view of the fact that the city of Montreal is the centre of a district which is capable of more water power development than most other cities in the world, it should have the advantage thereof in the shape of low electric power rates which are so essential to the growth of a city and to the full development of its manufacturing industries.

"This Board is of opinion that before the Dominion Government sanctions the various schemes now being put forward for the development of hydro-electric power on both the St. Lawrence and Ottawa rivers, it is essential in the interests of the country generally that the Conservation Commission should be requested to draw up a comprehensive scheme for the preservation of these rivers as great national waterways of this Dominion, and that such Commission should take immediate action so as to prevent the natural resources of the public domain from passing into the hands of private parties;

"That the Dominion Government is hereby prayed to instruct the Conservation Commission to consider what means it is advisable to adopt, first, in regard to the licensing of hydro-electric companies; second, what check it is desirable to put on the increases in the capital of the various companies in order that some means may be evolved for giving the public electric power at a minimum rate, yet at the same time allowing the various electrical companies to make a reasonable return to their shareholders on the paid-up capital; third, to prevent, if possible, such companies making unwarranted increases in their capital stock on the basis of earnings; and fourth, to consider whether a Hydro-electric Commission should be established on a similar basis to the Board of Railway Commissioners, or whether it would serve the public interest better for the government to itself develop hydro-electric power and distribute the same on lines similar to those of the Hydro-electric Commission in Ontario;

"That the Board is further of the opinion that all power developed in Canadian waters will be required for Canadian use, and that no power should be allowed to be diverted from this country;

"That this Board respectfully reiterates its request that in the development of water powers on the St. Lawrence and Ottawa rivers navigation interests should be considered paramount and that no works shall be permitted in these national waterways that would interfere with the development on a larger scale of their navigation facilities if the same should be found advisable."

Commercial Importance of Canada

No surer sign could be asked of the recognition of the electrical commercial importance of Canada by the old world than the rapidly increasing number of Canadian branches of long established British and continental houses that are being located throughout our Dominion. This recognition has been rather slow in coming, in part for the reason that they did not appreciate the magnitude of operations here, and in part that we did not appreciate the value of their products, perhaps believing that the differences between old and new world practices made their use impracticable and undesirable. The adaptability of the European manufacturer to new conditions has, however, already been conclusively shown, and Canada profits by the added keenness in competition as well as by the introduction of apparatus manufactured under conditions of superlative workmanship and engineering skill. It is gratifying too, to feel that, whatever our sentiments may be, mere sentiment need no longer

be a factor in determining the type of apparatus we shall purchase, since sentiment and quality lie in the same quarter.

We owe it to the new comers, however, that they should be given every fair consideration where new equipment is required. As much advance information as possible should be published and as long a time as necessary given for the submission of tenders. The time required for filling an order is daily becoming a less important factor because modern conditions of communication and transportation are gradually eliminating distances and also that most of the new branches carry a goodly stock of equipment and replacements which are immediately available. In some recent cases a non-observance of these facts has undoubtedly re-acted against the best interests of the purchasing parties.

Canadian Electrical Association

This year's convention of the Canadian Electrical Association will be held at the Chateau Laurier, Ottawa, June 19, 20 and 21. It will be the first convention to be held at this magnificent hotel, which is now nearing completion and will be opened in May.

Mr. J. H. Larmouth is chairman of the Papers Committee and an interesting convention programme is being arranged.

Toronto Section A. I. E. E.

Mr. F. C. E. Burnett, chief electrical engineer of the Canada Cement Company, read an unusually interesting paper before the February meeting of the Toronto Section A. I. E. E., on the electrical equipment and operation of a modern cement mill. The fact that this is practically the first paper of its kind that engineers have had the privilege of listening to and discussing added much to the interest of the evening's proceedings. The paper was well illustrated showing the process of manufacture from the quarry to the finished product.

Judging by Mr. Burnett's description of the plant and by the photographs shown, the requirements of electric motors in a cement mill are heavier than in almost any other type of work which a motor can be asked to do. The photographs showed the motors covered with cement and clay dust and the speaker stated that these would become clogged up to such an extent that he has seen a bank of lamps lighted across the insulation. That apparatus can be constructed to stand up against such requirements must be highly satisfactory to the manufacturer of the present-day electrical equipment.

The speaker took it for granted that electric drive was the only possible satisfactory drive in a cement mill. Direct current, which was used to a greater extent some years ago has been almost entirely replaced by alternating current. A d.c. motor is of special value on account of its variable speed characteristics but as most of the equipment in a cement mill is run at constant speed, this characteristic is of little value here. The a.c. system is cheaper to install and the starting equipment less complicated and cheaper to maintain. The writer discussed the best voltage to be standardized under these circumstances, and stated that, everything considered, he had found 550 to be the maximum that could be satisfactorily used throughout. A higher voltage could be used on some of the motors but inasmuch as quite a number of 5 to 10 h.p. motors were required which could not satisfactorily be built to operate on a higher voltage than about 550, this latter figure had been chosen by his company.

As between the various types of motors, that is, the squirrel-cage induction, the slip-ring and the internal resistance type Mr. Burnett favored the squirrel-cage, though the slip-ring type is suitable for hoisting and similar work. The latter type is also advocated in some places, on account

of the high starting torque, but it is necessary to provide a separate motor house to keep it, as far as possible, from the dust of the mill. The internal resistance type was not favored, on account of it requiring much more intelligent operation than is generally available in this class of mill. Both of these later types possess the necessary high starting torque, but are, in general, more expensive, less easy to maintain and much more likely to give trouble through destruction of the brushes should the motor be thrown on the line with all resistance out. To gain the required torque with the squirrel-cage motor it is necessary to install larger motors than would otherwise be required; for example, where a 150 h.p. would normally be used a 175 h.p. would have to be installed.

Individual drive was favored from an operating point of view. Group driving has some advantages in lower power consumption; lower cost of belt maintenance, more economical type of motor and lower initial investment for equipment, but against these there is the lack of flexibility requiring the shutting down of a large part of the mill if one machine gets out of order. A good combination is to group all the heavy machines and to use individual small motors for the lesser drives such as conveyors and elevators.

The choice of frequency is not of great importance and may be anything from 25 to 63 cycles with leanings towards the lower limit. The voltage is a much more important question, especially on account of the difficulty of insulating. As a result nothing over 550 was advocated. The wiring is best carried out on the open principle throughout. In this way cable faults are practically eliminated and when they do occur are easily located and corrected. The system of lighting advocated is arc lamps wherever possible.

The New Code Wire

In November last after several conferences between representatives of the Underwriters' Laboratories and the rubber covered wire manufacturers of the United States an agreement was reached for the re-establishment after January 1st, 1912, of a single label factory inspection service operating under the new 1911 National Electric Code specifications. This service represents a merger of the Wire Inspection Bureau service on National Electric Code rubber covered wire with that of the Underwriters' Laboratories; it will be under the direct operating control of the latter organization and is based on specifications and procedure representing the best thought of the underwriters and the rubber covered wire manufacturers. The procedure under this service is not only very thorough at the factory but also contains a rigid follow-up system in the field, and can hardly fail to be much more productive of results than anything in this line which has so far obtained. The majority of rubber covered wire manufacturers of the United States have agreed that on and after January 1st, 1912, all new National Electric Code rubber covered wire manufactured by their companies shall be duly tested under the new specifications and will bear the identification label of the Underwriters' Laboratories as evidence of this conformance to these specifications. After July 1st the United States manufacturers will cease selling the present code wire.

More recently the Canadian rubber wire manufacturers and the chief electrical inspectors of the Canadian Fire Underwriters' Association met in Toronto and agreed to adopt the specifications set forth in the National Electric Code. It is not anticipated that the Canadian factories will be able to dispose of their present code wire in less than one year but it has been agreed that after January 1st, 1913, no more of the old wire shall be placed on sale. It is probable that very little more, if any, of the old wire will be manufactured and that the manufacture of the new code wire will begin during the last half of this year. The new specifications are

very exhaustive and satisfactory. A copy of the National Code requirements, printed in full, will be found on another page of this issue.

Dryden Timber and Power Company

Contracts have just been awarded for the complete electrical equipment of the plant of the Dryden Timber and Power Company at Dryden, Ont. The equipment includes generators, switchboards, short transmission line, distribution system and a variety of operating motors. A detailed description of the complete order follows:—There will be two 1,000 h.p. Francis type water-wheels direct-coupled to two 750 kv.a., 575-volt, 3-phase, 60-cycle, 360 r.p.m. generators. The water-wheels will be supplied by James Gordon & Co. The generating plant also includes two direct-coupled exciters each capable of exciting both of the 750 kv.a. generators. The transmission line is of aluminium wire, 900,000 c.m. cross section and about a mile long.

The motors used to operate the various pulp equipment throughout the mill vary in size from 8 to 225 h.p. and number 25 in all as follows:—two 8 h.p., three 10 h.p., three 13 h.p., one 20 h.p., three 25 h.p., one 35 h.p., three 50 h.p., one 70 h.p., one 90 h.p., three 100 h.p., two 120 h.p., one 225 h.p., one 250 h.p. Of these motors the two largest are the wound rotor type but all the others are squirrel-cage motors.

All the above electrical equipment together with the switchboard complete is being supplied by the engineering firm of Chapman & Walker who will also have charge of the erection of the entire system. The total order will approximate \$80,000.

In addition to the above a number of centrifugal pumps also motor driven are being supplied by the W. H. Allen, Son & Co. The various pumps with their sizes and the uses to which they will be put are:—one 1,000 gal. unit. for pumping caustic liquor, driven by a 22 h.p. motor against a 55 foot head; one 1,400 gal. unit for main water pumping operating at a 105 ft. head and driven by a 52 h.p. motor; three 450 gal., 33 foot head, caustic liquor pumps each operated by an 8 h.p. motor; four 375 gal., 25 foot head, pumps specially installed for operating the digesters under 125 lbs. pressure, each operated by an 8 h.p. motor; and one 1,000 gal. boiler feed pump working under a 370 foot head and driven by a 20 h.p. motor. All the above pumps are centrifugal type and direct-connected to the motors. The main water and boiler feed units are medium and high lift turbine types respectively.

C. G. E. Erecting Fine Buildings

The Canadian General Electric Company, Limited, are erecting at their Peterborough works a new Stores Building, 425 feet in length by 80 feet in width, equipped with electric cranes and all other modern facilities for handling stores of finished apparatus and raw materials. Owing to the growth of the company's business the volume of materials to be handled has increased to such an extent that the erection of the new Stores Building has become imperative, and when completed will add very greatly to the facilities of the Peterborough works.

A handsome office and warehouse building will also be erected in Montreal. The Canadian General Electric Co. Ltd., have branch offices and warehouses located as follows: Halifax, Montreal, Ottawa, Cobalt, Porcupine, Winnipeg, Calgary, Nelson, Prince Rupert and Vancouver. The head office building in Toronto, Halifax office and warehouse, Winnipeg office and warehouse, Vancouver office and warehouse, and the Porcupine office and warehouse are owned by the company, and have been built especially with a view to the requirements of the company. In Montreal, however the company occupy a rented building, the lease of which ex-

pires in 1912, and which the operations of the company have outgrown for some time. They have now purchased a splendid building site on St. Antoine street, opposite the new Windsor street station of the Canadian Pacific Railway. Plans and specifications have been prepared by Messrs. Ross & MacFarlane, architects, and accepted by the company, which will provide for a very handsome office and warehouse building, 45 feet by 150 feet, five storeys in height, built of cut stone and pressed brick, which it is anticipated will be ready for occupancy by the end of the current year.

Hull Electric Company Extensions

The Hull Electric Company has a considerable amount of extension work under way, including a new car shed at Hull, sub-station at Aylmer, an office building at Hull, track extension at Deschenes and a quantity of replacement work throughout the track system.

The first section of the car shed at Hull is well advanced and will have a capacity of twenty-seven 30-foot cars. The building will be constructed of steel with brick walls. In the sub-station at Aylmer a 250 kw. motor-generator set will be installed and a pole line transmitting at 11,000 volts is being built from the Deschenes power house to this point. This apparatus has been purchased from the Canadian General Electric Company.

In connection with the office building at Hull a property has been purchased on Main street and is now being remodelled to fill the street railway requirements. Under the item of track extensions a double track line will be laid a distance of three-quarters of a mile connecting with the Ottawa Racing Association's racing track. Also six miles of light rail will be replaced with heavier rail on the suburban section and three intersections, now composed of 56 lb. rail, will be replaced by 127 lb. manganese steel.

These extensions and additions are under the direct supervision of Mr. G. Gordon Gale, general superintendent of the Hull Electric Company.

10,000 h.p. for Quebec

The Stadacona Light, Heat & Power Company has been incorporated in Quebec with a capital of \$2,000,000, of which one million is in ordinary shares and one million in bonds, the greater part of the latter being taken up in Brussels and Paris. The company will develop hydro-electric power, and will supply energy for light, heat and motive purposes. It is officially announced that the company has secured the rights to carry out the electrical development of the Seven Falls, at St. Ferreol, twenty-five miles from the city of Quebec, and it is proposed to develop about ten thousand horse power of electrical energy. The total amount of electricity to be generated has been sold under long term contracts to the Quebec Railway, Light & Power Company for distribution in Quebec and the vicinity, and for motive power to the Bayless Pulp & Paper Company, who will erect at Beupre a pulp and paper mill of a capacity of 100 tons of paper a day. The board of directors comprise: President, the Hon. L. P. Pelletier, M.P., Quebec; Sir Rodolphe Forget, M.P., Montreal; Neuville Belleau, Quebec; A. Bouvier, Brussels, Belgium; the Hon. C. E. Dubord, Quebec; H. J. Biermans, Shawinigan Falls; D. O. Lesperance, M.P., Quebec, and Andre de la Morinerie, Rheims, France.

London Waterworks Equipment

In connection with their water pumping equipment situated at Springbank, some two miles from the city, the water commissioners of London, Ontario, will install two 550 volt, 3-phase synchronous motors. One of these will be used to drive their No. 3 turbine pump which is at present driven

by a 150 h.p. gas engine and will be so connected up with a clutch on each side that it can be driven either by the gas engine or the motor. This motor will have 150 h.p. mechanical rating but will have a wattless current capacity of either 250 or 350 kv.a. for power-factor correction.

The second motor will be used in connection with a fourth air compressor. This air compressor will probably be of the rotary or turbine type, which will enable the motor to be direct-connected to it. This motor will have a mechanical rating of 100 h.p. and also a wattless current capacity of 250 or 350 kv.a. for power factor correction. H. J. Glaubitz, C. E., General Superintendent of the Waterworks and Electrical Department, is in charge of the installation.

New Equipment for Smiths Falls

The Smith's Falls Electric Light and Power Co. have just increased their equipment by the addition of a 500 h.p. vertical enclosed compound, high speed, forced lubrication type, Goldie & McCulloch engine and a 200 kw., 500 to 550 volt, d.c. Canadian General Electric generator. Another generator of 300 h.p. capacity will be installed in the near future.

Up to the present time the Smith's Falls generating equipment consisted of three water turbine driven generators with a total output of about 500 h.p. When the full equipment is in, this total will be raised to a normal capacity of 1,000 h.p.

The installation of the new apparatus is under the supervision of the superintendent of the plant, Mr. A. S. Fraser.

Electric Power Company's Extensions

Work on the Electric Power Company's system is steadily progressing. Three 500 kw. generators are now in operation in the power house of the Auburn Power Company. Part of the power generated in this station is delivered in Peterborough, and the remainder is now being transmitted over the 44,000 volt transmission line which connects Peterborough with Port Hope. The total length of the 44,000 volt transmission line on the Electric Power Company's system has now been brought up to about 250 miles. The Millbrook and Newcastle sub-stations have recently been placed in operation. Transmission lines are now being extended to Napanee and Lindsay and it is expected that power will be delivered in Napanee before the end of March and in Lindsay early in the coming summer.

Contracts have been awarded for all of the equipment for the new power house at Dam No. 5 at Frankford, Ont. Construction of this power house is being rapidly pushed and it is expected that it will be in operation early in the summer. The equipment consists of four 600 kw., 60 cycle, 3 phase, 6600 volt, vertical shaft generators at 112½ r.p.m., manufactured by the Swedish General Electric Company who will also furnish one turbine driven and one induction motor driven exciter for this power house. The Canadian Boving Company will furnish three 75 kv.a. transformers, and the Monarch Electric Company of Montreal, the switching equipment and cables. Power is generated at 6600 volts and transmitted about four miles at this voltage to the transforming station of the Sidney Electric Power Company where it is stepped up to 44,000 volts for distribution over the Electric Power Company's system.

The erection of a power plant near Bellingham, Wash., is contemplated by Smith, Kerry & Chase, a Toronto firm of engineers. A tract of land west of the city water rights in the middle fork of the Nooksach River has been acquired by the company, and it is reported power will be generated for the use of the Balfour-Guthrie cement plant now being erected in the vicinity.

LAKES COQUITLAM-BUNTZEN TUNNEL

Great Work Just Completed Near Vancouver, B.C.—Generation of 85,000 Horse Power Made Possible

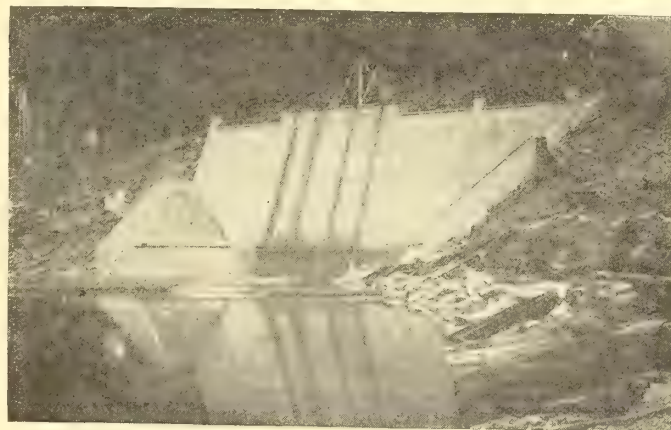
The Vancouver Power Company, a subsidiary concern of the British Columbia Electric Railway Company, Limited, has recently completed the enlargement of its hydraulic tunnel connecting Lakes Coquitlam and Buntzen, forming part of the company's great hydro-electric generating system on the North Arm of Burrard Inlet. From this plant is sent, to meet the company's demands, over the 1,600 square miles of territory surrounding Vancouver, electrical energy to the extent of 43,500 horse power at the present time. In the February number of the *Electrical News* mention was made that the company had awarded contracts for the extension of its North Arm power plant during 1912 by adding three units of 14,000 horse power each, bringing the possibilities of the plant up to 85,500 horse power. As an auxiliary, in case of accident at the hydro-electric plant, or to the transmission lines bringing the power from the North Arm to the various substations, the company also operates a steam plant, generating 12,000 horse power, in Vancouver, and work is now being carried on for the enlargement of this plant to an output of 20,000 horse power.

The enlargement of the tunnel connecting Lakes Coquitlam and Buntzen forms a step in the great extension of the company's generating plant during 1912. Lake Buntzen is a body of water 500 acres in area, located at such an elevation that the water from the dam at its outlet can be delivered to the hydro-electric plant on the shore of the North Arm at a head of 400 feet. The drainage area of the lake is not, however, sufficient to meet the company's demands, and to supply this deficiency water is drawn through a hydraulic tunnel over two miles in length from Lake Coquitlam, which has an area of 2,300 acres, and a drainage area of 100 square miles.

After several years' work the company completed in 1905 its original hydraulic tunnel connecting the two lakes. This sufficed to meet the demands for a time, but as the company's business developed at a rapid rate it soon became necessary to plan for the extension of the plant. A development undertaking was decided upon for increasing

water which is necessary for the operation of the enlarged plant, the work of enlarging the hydraulic tunnel, just completed, was planned.

The mountain separating Lakes Coquitlam and Buntzen is about 4,000 feet in height, the composition being of hard granite. The original tunnel connecting the lakes, completed in 1905, after continuous work extending over several years, was approximately 9 by 9 feet. The enlargement work just



Head Gates of Enlarged Tunnel, Lake Coquitlam

brought to a successful conclusion was directed upon the roof and one side of the old tunnel and has made a channel about 12 feet by 16 feet in size. The total length of the tunnel is about 12,775 feet.

The original plans for the enlargement contemplated the work on the roof and side of the old tunnel for a distance of 8,000 feet from the Lake Buntzen portal, from which point a twin tunnel was to be driven to Lake Coquitlam. In carrying on the work, however, such rapid progress was made on the enlargement work that the plans were altered and the old tunnel was enlarged from end to end. The enlargement was started in September, 1908, and the progress at the start was not very satisfactory. In July, 1910, it was reported that only 2,000 feet had been completed, and vigorous measures were taken to press the work. As the result of this policy the remainder of the work, over 10,000 feet in length, was completed by March 16, 1911, with the exception of the final cleaning out. The rapid progress of the work in its later stages reflects great credit upon the company under whose direction it was carried on.

The largest number of men employed on the work at one time was 425, the day's work being divided into two shifts. At one time fifty-two machines were in operation and 850 horse power of air employed. The greatest progress was made during October, 1910, when the records show that the enlargement advanced at the rate of over 100 feet per day on several occasions. The material taken from the tunnel was carried to the portal by an electric tram line laid on the tunnel floor, several trains of dumps being used. The largest day's work noted on the records shows a total "dump" of 735 cars. Rapid as the work was carried on in its final stages, it would have been done still more rapidly were it not for the exigencies of the case, which demanded that from time to time the water supply in Lake Buntzen be replenished. This meant the cessation of work in the tunnel for a shift or so and somewhat delayed the progress.

In connection with the enlargement of the tunnel, work was carried on covering the construction of a new forebay at the Lake Coquitlam portal, adequate for the demands when the 90 foot dam is completed. The construction of the new forebay necessitated the tearing out of the work originally

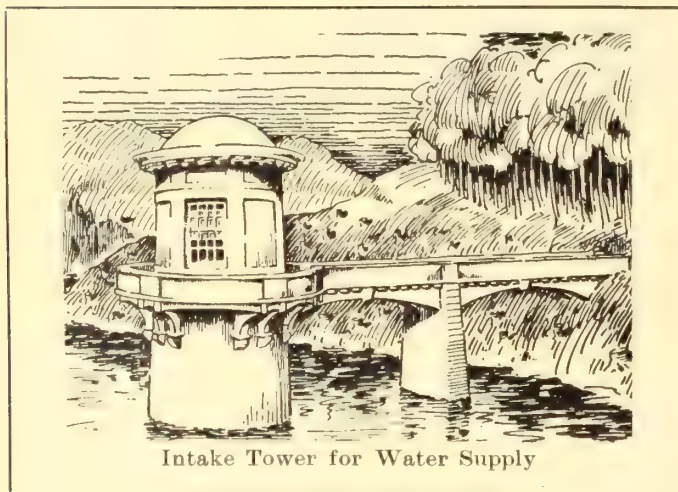


Work on Tunnel Connecting Lakes Buntzen and Coquitlam

the available water supply for the North Arm plant by building a dam 90 feet in height to replace the temporary dam at the mouth of Lake Coquitlam, thus giving a storage reservoir with a capacity of 9,000,000,000 cubic feet. Work on this large dam is now in progress and will be carried on while the three 14,000 horse power units which the additional hydraulic energy is to operate are being installed at the North Arm generating station. To convey this greater volume of

placed at the tunnel portal and the substitution thereof of a far more extensive construction. This consists of a masonry wall seventy-five feet in height and having a width of 50 feet at the intake, the plans providing for a width of 150 feet at a point 100 feet from the entrance to the tunnel. On the face of the forebay is placed a rack to prevent surface floatage from entering the tunnel. This rack is made of 60 lb. rails joined to heavy I-beam frames, and suitable provision is made for hoisting and lowering the rack according to the height of water in the lake.

The entrance of the water into the tunnel is regulated by two methods. For general operation two Stoney sluice gates, each 4 ft. 6 in. in size, made in England, are employed. To meet emergency conditions which may arise, a nine foot Coffin valve, placed in a Venturi throat, is located nearer the tunnel entrance. Both the Stoney gates and the emergency valve are operated from above, separate shafts having been sunk through the rock in which the operating mechanism is placed.



Intake Tower for Water Supply

The city of New Westminster draws its water supply from Lake Coquitlam, and in connection with its development work at this point the Vancouver Power Company is expending \$500,000 in order to ensure the city a supply of pure water ample for the demands of this rapidly growing centre for many years to come. The new intake for the New Westminster water supply will be 110 feet in height. It will be located at the head of a tunnel 1,900 feet in length, driven through solid granite, and at a point which enables the supply to be taken from the deep water of the lake.

The water is taken at a point 10 feet below the level of the lake and within the tower is a complete service of copper screens, arranged in duplicate for facility in cleaning. The tower is similar in type to those erected at Birmingham, Liverpool, Edinburgh and other points in the old country, where they have given perfect satisfaction.

Other work of the company in connection with the New Westminster water supply consists of extensive clearing operations, covering the new areas which will be flooded when the high dam is completed. 600 men were engaged on this work last fall and the estimated cost of the clearing alone is in the neighborhood of \$250,000.

A Bill is being introduced in the Ontario Legislature by the Hon. J. S. Hendrie requiring the removal of telegraph, telephone and electric lighting poles and the placing of wires for these services under ground, in municipalities of any considerable size. The municipality, it is understood, will have power to enforce this work on any private operating company.

AS ONE ENGLISHMAN SEES US

The impressions made on a British Manufacturer by Our Electrical Activities

A member of a prominent British electrical manufacturing house who spent some months in Canada and the United States during the past summer has embodied his impressions in an interesting letter to the *Electrical Times*. General impressions from an impartial and interested observer often size up the situation more accurately than a study at too close a range can do. The writer has, of course, made a slip when he used the word "extravagance." He meant "development" or possibly "extravagant development," to which he makes one or two specific references. The following extracts from the letter will be read by Canadians with interest.

"The two outstanding impressions I have of electrical matters in Canada and the States—and by outstanding I mean the things that leap to one's mind without any effort at thinking of them—are the vastness of the business and the extravagance.

"One cannot travel across that huge continent without appreciating the enormous possibilities before it or without feeling that Earl Grey's prophecy that Canada will one day be the centre of the Empire is not a mere complimentary phrase, but is a forecast that has every likelihood of fulfilment.

"Central station men here in England speak of a good load factor for the station when dealing with the twenties. In Montreal, the Montreal Light, Heat & Power Company had a load factor for the year of about 80 per cent. This is made up by public and private lighting, power and traction. In spite of 'heat' being included in the name of the company, there is not much of this done electrically (although they sell a good deal of steam for this), because climatic conditions make a furnace necessary in every house and because the same company own the gas undertaking—a not unusual thing on that side, but one which I can see is retarding electrical cooking in such towns.

"Some particulars of big American plants have already appeared over here so I have no need to go into these details, but one point I must mention in this connection. Of course, I visited the Niagara Falls and was as deeply impressed with that wonderful sight as everybody with any imagination must be, but I also visited the hydro-electric station of the Toronto Power Co., and there the impression was far deeper than that produced even by the Falls themselves. I don't feel that this is a case for quoting figures—no figures could convey any idea of the greatness of this scheme, and the splendid manner in which it has been carried out. Everything, from the noble Greek Temple sort of building, with palms scattered about in great profusion, down through the various polished floors to the tail-race 150 feet below ground level, is a triumph of man's handiwork.

Extravagant Lighting

"I mentioned that my second chief impression was the extravagance. Lighting is used everywhere with a prodigality that sets an outsider gaping. In hotels, in place of the one or two plain pendants that are common here in the ordinary bedrooms, I found three to eight-light electroliers besides various brackets. Five is the least number of lamps that I have seen in a hotel bedroom, while even in the bathroom (attached to each bedroom), there are often two lights. The extravagance does not end in the number of lamps, but is continued by these lamps being left on by visitors when not required. It seems to be considered 'infra dig' for guests to switch lights out, and consequently they are usually left going until the chambermaids turn them out. In offices, too, the rent usually covers lighting and heating, so there is no inducement for the tenants to switch off when

leaving for the night—more especially as lamps are renewed free of charge. I have little doubt that the fine load factors obtained are due in a great measure to this same extravagance all round.

"But for extravagance allied to inefficiency, the street lighting is easily first. A fashion which is rapidly overtaking all the towns is to put in five-light clusters placed about 30 yards apart, and exactly opposite each other along both sides of the street. These clusters take 500 watts each, and to make up for the waste the lamps are enclosed in opal globes sufficiently opaque generally to prevent the outline of the filaments being seen. The effect, it must be admitted, is very fine, the streets being flooded with a beautifully soft light, and the perspective of such a street is delightful, but one cannot help thinking that those 500 watts could be employed to even better advantage, while it makes one sigh to think of our struggle here with converted gas lanterns. The maximum of inefficiency in street lighting is surely reached in some single-light fittings on concrete poles in Toronto. These look very pretty—the fitting, not the poles—but by night merely serve to mark out the road, just as we place whitewashed stones along a country road. The light they give is hardly sufficient to see themselves by, and leaves the road in almost complete darkness. Yet, understand, they are 100 watt lamps! Locally these fittings have been described as 'steins,'—i.e., German drinking mugs with lids—which is a pretty accurate description. In Philadelphia the street lighting is carried out with arc lamps fitted with blocks of carbon quite three inches wide, instead of the usual rods. The arc plays backwards and forwards along these in much the same way as in a multicarbon lamp, such as the Davy flame arc.

More Tungstens in England

"The street lighting in many towns gets a good help from the innumerable signs. A method of electrical advertising that is being pushed a good deal in Chicago is the outlining of buildings with incandescent lamps. This, of course, helps the street lighting enormously, and looks very fine in itself.

"Generally, arc lamps are on the decline. Magnetite arcs, which I see are now being advertised over here, are used on a.c. systems in conjunction with mercury rectifiers.

"Another thing I could not get explained was the general use of push-button switches. These are not nearly so convenient as tumbler switches and must be a lot more expensive. Perhaps this item of expense accounts for the fact that even in first-class hotels very few bedrooms have two-way switches giving control from bedside as well as from doorway.

"Tungsten lamps are not in such general use as here, due mainly to the free renewal of lamps by the supply authorities, who are letting themselves down gently. With a general voltage of 110 there is none of the rush on auto-transformers that we experienced here.

"Questions of charging are just as much in the melting pot as with us. Everyone is trying to get away from the contract system, known there as the flat rate, i.e., unlimited use of a stated demand in return for a fixed charge per annum. Current limiters are being employed in many cases, but the m.d. system is getting very general in some form or other. The 2-rate system also is beginning to be looked into.

"In conclusion, if this article should meet the eyes of any of the disconsolate gentlemen who air their qualifications and lack of a good job in the pages of the technical press nearly every week, let me advise them to go to Canada. For one thing, if they can only become ordinary human beings for a while they can get at least 45 cents an hour as wiremen, which will keep them going till their genius gets the inevitable recognition. For another, they will see that we are really living in an electrical age."

GOVERNMENT SHOULD OWN TRUNK LINES

The Question of Government Ownership of Telephone, Telegraph, and Cable Wires Discussed in Parliament

The subject of telephones, telegraphs, wireless telegraphy and cables occupied the attention of the Dominion Parliament recently through the introduction by Mr. J. E. Armstrong, M.P. for East Lambton, of a resolution calling for the appointment of a committee to investigate the possibilities of nationalizing our telegraphs, telephones, wireless telegraph system and cables. The resolution was as follows:—

"That, in the opinion of this House, a commission should be appointed to investigate the systems of national telegraphs and telephones, wireless telegraphs and cables, also postal conditions, laws and regulations, parcel post, means of collecting and distributing mails, with a view to submitting such data and information to the Post Office Department as would help to improve existing conditions in all the above, and to further inquire into postal facilities in rural districts in other countries in order that a better system of rural free mail delivery may be inaugurated.

In support of his motion Mr. Armstrong spoke in part as follows:

"I think we should go about acquiring these great public utilities under common-sense business methods, and there is no question in my mind that if they were nationalized they would become a source, not only of revenue, but of great advantage to the people of Canada. There are five great means of transmitting intelligence in this country: The telegraph, the telephone, wireless telegraphy, cables, and the post office. All these means of transmitting intelligence are of vital importance to every man, woman and child in the country. It is, therefore, our duty to investigate and gather statistics with regard to these important facilities, with a view to nationalizing them, and making them part and parcel of the Post Office Department of Canada. I propose to give some reasons for asking for this legislation. To-day we have 8,000 miles of telegraph lines, owned, controlled, and operated by the Dominion government; and these telegraph lines, instead of being a source of revenue to the government, cost this country last year the sum of \$270,000. We have over 600 offices for the management of these telegraphic enterprises. The largest telegraph company we have in the Dominion of Canada, namely, the Canadian Pacific Railway Co., control, own and operate over 12,000 miles of pole lines, and over 76,000 miles of wire, and their income, after paying all expenses, amounted last year to the handsome sum of \$1,270,000.

Capital Returned in Six Years

"The books which the Canadian Pacific Railway placed at the disposal of the Railway Commission within the last few weeks, show that they only invested in that enterprise, \$6,600,000. You can readily see that within six years, by that method of calculation, the amount of capital invested would be returned to them in dividends.

"Let us take the next greatest telegraph company we have in the Dominion, the Great Northwestern, with its 11,000 miles of pole lines and its 50,000 miles of wire. They have been able to cover up their earnings to a very great extent because a large portion of their stock is held in the United States and the enterprise is controlled and operated from that point. If you take into consideration all other telegraph lines in the Dominion of Canada—and when I say that, I am speaking in reference to the telegraph lines of the railways—you will come to the conclusion that the Canadian Pacific Railway own, operate and control over half the miles of pole line and wire in Canada and if that company are able to place before the Railway Commission figures which go to show that they have only invested \$6,600,000 in the enterprise, it is not too much to expect that if we were

to attempt to purchase all the telegraph lines and wires in Canada the cost should not exceed \$13,000,000 or \$14,000,000. But then, you would have control of the telegraph wires that operate our railways; so that you have to take from that the wires necessary to operate the railway systems. When you came to figure it up you would find that you could not possibly invest more than, say, \$10,000,000, in order to enable you to own and operate the commercial telegraph lines.

"Now, I desire to refer to the telephone companies and to call your attention to the fact that we have 460 independent telephone companies in Ontario while, in the Dominion, it is estimated that we have in the neighborhood of a thousand telephone companies. In the United States they have 15,000 independent telephone companies operating over 4,000,000 telephones and costing, as they claim, over \$400,000,000. The independent telephone companies in our country are practically on their knees to the great Bell Telephone Company, especially in the eastern provinces and—the proposal that I have to make to parliament is that we should own the trunk lines of telephone, that these trunk lines should go to the independent companies and let the municipalities of the independent companies own, control, and operate their lines and make them local concerns. After investigating to some extent the operation of telephone lines in different foreign countries I find that the most feasible plan, as far as Canada is concerned, is that we should at once either take over the trunk lines and operate them or else build trunk lines in Canada in connection with the telegraph lines because we must recognize that the telegraph and telephone should go hand-in-hand. Wires that are used for one service can readily be used for the other. The provinces of Manitoba, Saskatchewan and Alberta own and operate their own telephone systems. We should, at the earliest possible date connect up the eastern trunk lines with that great north-western country and with these great western provinces so that we will be able to assist in such a way as would be possible, did we own, as we should, the telegraph and telephone lines running through that western country.

"In many foreign countries they have systems whereby they do control, own and operate all the telephone and telegraph lines in those countries, such as Germany, but in other places, where they own and operate trunk lines and where they have connected them up with the municipalities they find that it is an altogether better system and that the conditions which arise in the different municipalities are such that they have an altogether better service.

Government operates Lean End of Business

"We have in Canada some twenty-five wireless telegraph stations. These stations have cost Canada from \$10,000 to \$20,000 each and in addition to this we are paying tens of thousands of dollars to the Marconi Company to operate a large proportion of those wireless telegraph stations. We are in this position with regard to these great utilities. As far as the telegraph system is concerned we own and control the lean end of it, the productive end being turned over to the great monopolies. It is the same with the telegraph system. You find rural districts doing their utmost to gather together a sufficient number of people to organize independent companies in rural districts in order that they may have some of the comforts which accrue from a telephone system. But the productive end of the telephone system is owned, operated and controlled by the Bell Telephone Company in Ontario and Quebec and in some of the eastern provinces by other telephone companies. The wireless telegraph stations are in much the same position. We have some twenty-five wireless telegraph stations in Canada. Fifteen of these stations are controlled by the Marconi Telegraph people. They are the profitable end of the wireless telegraph stations. The unprofitable end of that whole sys-

tem is operated by this government at a very great loss. I am a firm believer in wireless telegraphy being taken over as a public utility and placed under the control and operation of this government.

"I would like to place before the House some figures with regard to the telegraph systems of Canada. Canada owns in government telegraphs and cables, 8,406 miles, of which 8,150 miles are telegraph lines, or land lines. She has 603 offices, and the number of messages sent in 1910-11 amounted to 249,915. The expenditure in 1910-11 amounted to \$432,970.04, while the revenue amounted to only \$169,585.15, leaving a deficit of \$263,384.89.

"The Great Northwestern Telegraph Company, the only one that competes with the Canadian Pacific Railway in extent of mileage, own, as they did in 1910-11, 11,234 miles of pole lines, and 50,092 miles of wire line, and sent 2,907,495 messages, having only 1,183 offices, or less than double the number of offices run by the Canadian government, and send over ten times as many messages.

"The Canadian Pacific Railway Co. in that year operated 12,257 miles of pole lines, with 76,175 miles of wire, sending messages to the extent of 3,431,493, and the total number of their offices is 1,372, or a little over double the offices now operated by the government.

"The Western Union, the third largest of the chartered companies, in 1910 had 2,639 miles of telegraph pole lines, with 11,024 miles of wire, sending 551,764 messages, with 217 offices.

"The North American Telegraph Company, Limited, in 1910 operated 605 miles of line and 783 miles of wire, and sent 38,015 messages with 83 offices.

"The Grand Trunk Pacific Railway in 1910 operated 1,699 miles of pole lines, 5,081 miles of wire, and 71,154 messages, with 73 offices.

"The Algoma Central Railway in 1910 had 130 miles of line, 174 miles of line wire, sent 3,639 messages, and had only four offices.

"The Temiscaming and Northern Ontario Railway in 1910 had 265 miles of pole line and 1,865 miles of wire, and sent 131,106 messages with twenty-two offices.

Half Canadian Lines are C. P. R.

"You will readily see that the Canadian Pacific Railway Company own and operate nearly half the total number of miles of pole line in the Dominion, and over half the miles of wire, and send nearly half the messages; so that with an estimate placed before you by that company of less than seven million of dollars as the value of their pole lines, lines of wire, etc., the estimate I have made of \$15,000,000 would be more than sufficient to purchase all the telegraph lines in existence in Canada to-day. The annual charge for this amount of money at three per cent. would be \$400,000. In order to make the proposition pay interest at three per cent. on \$15,000,000 you would need a surplus of \$400,000 per annum. The surplus of the Canadian Pacific Railway telegraphs operating half the proposed mileage has been over one million per year on the average for the past six years. If, on the other hand, we were to buy the Canadian Pacific Railway system and charged them so much for operating their trains over that system, the government getting the rest, there would be a still greater revenue. At the present rates of messages the government could count on a profit of one million dollars per year. So on an investment of \$7,000,000 the government could count on having their money returned in at least six years, or the earnings could be applied to a reduction of rates.

The speaker then went at length into the question of discrimination, in telegraph rates, between various points in Canada, pointing out a number of examples, such as, that between Rimouski and Windsor, a distance of 900 miles, the rate is 25 cents, while between Winnipeg and Edmonton,

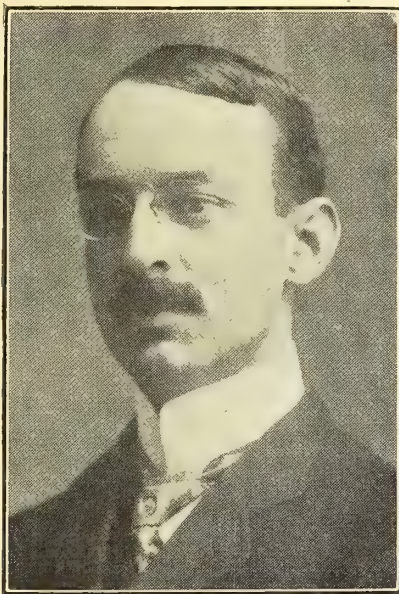
a distance of 800 miles, it is 75 cents, and between Regina and Saskatoon, only 160 miles, it is 40 cents. The speaker also drew the attention of the House to the position recently taken by the Postmaster-General of the United States, who had announced that he was personally in favor of the government taking over the telegraph lines at a cost, if necessary, of \$250,000,000.

Emphasis was also laid on the fact that a number of the rural districts in the older provinces of Canada are being quite rapidly depleted of their population and the likelihood that this undesirable exodus from the farms could be prevented by bringing within the reach of our rural inhabitants modern conveniences and comforts such as telephones and daily mail deliveries.

Speaking of cables, Mr. Armstrong advocated the laying and operating of a Canadian cable or two, connecting Canada with England. He believed the cost of a cable would not exceed \$5,000,000, and that it would prove not only a profitable investment, even charging much lower rates than at present obtained, but that such a cable would greatly strengthen the bonds between Canada and the motherland. A quantity of interesting statistics on the telegraph business in Canada as carried on by the different companies was also given. It was pointed out, however, that it was not possible to get statistics on telephone operations, and the speaker took occasion to mildly censure the department in charge of this work for the entire absence of any assistance which this department had been able to give in the preparation of his information.

Mr. Bennett is Chairman

Mr. James Bennett, chief electrical inspector for the Province of Quebec of the Canadian Fire Underwriters' Association, Montreal, and Mr. R. J. Swain, city electrician, St. Boniface, Man., represented Canada at the seventh an-



Mr. James Bennett,

Chief Inspector, Canadian Fire Underwriters' Association, Montreal

nual convention of the Western Association of Electrical Inspectors, held at Milwaukee, Wis., on January 23, 24 and 25. In the election of officers Mr. Bennett was promoted from second vice-president to chairman of the executive committee. These meetings were very interesting and well attended, delegates on the first day numbering 175. Some important recommendations to the electrical committee of the N. F. P. A. with respect to the wire situation and the use of nails with knobs or cleats, etc., were made.

THE NEW NATIONAL CODE WIRE

Full Text of the Specifications—Old Code Wire cannot be sold after the present year

a. Copper for conductors must be thoroughly tinned.

Insulation for voltages, 0 to 600 inclusive.

b. The insulation must consist of a rubber compound, homogeneous in character, adhering to the conductor or to the separator, if one is used, and of a thickness not less than that given in the following tables, sections e and f. Measurements of insulating wall are to be made at the thinnest portion of the dielectric.

c. Any one foot sample of completed covering must show a dielectric strength sufficient to resist throughout five minutes the application of an electro-motive force proportionate to the thickness of insulation in accordance with the following table:—

Thickness in 64ths inches.	Breakdown test on 1 foot
1	3,000 volts a.c.
2	6,000 " "
3	9,000 " "
4	11,000 " "
5	13,000 " "
6	15,000 " "
7	16,500 " "
8	18,000 " "
10	21,000 " "
12	23,500 " "
14	26,000 " "
16	28,000 " "

The sources of alternating electro-motive force shall be a transformer of at least one kilowatt capacity. The application of the electro-motive force shall first be made at 3,000 volts for five minutes, then the voltage increased by steps of not over 3,000 volts, each held for five minutes, until the rupture of the insulation occurs. The tests for dielectric strength shall be made on a sample wire which has been immersed in water for seventy-two hours. One foot of the wire under test is to be submerged in a conducting liquid held in a metal trough, one of the transformer terminals being connected to the copper of the wire and the other to the metal of the trough.

d. Every length of completed wire or cable must be tested after not less than 12 hours immersion in water, and while still immersed by the application for one minute of an alternating current voltage derived from apparatus of ample capacity, the test voltages to be those given in the tables of sections e and f. After this voltage test every length of completed wire or cable while still immersed must show an insulation resistance after one minute electrification not less than the values given in sections e and f. Any length of completed wire or cable may be tested during 30 days immersion in water, and must show not less than fifty per cent. of the insulation resistance required after the 12 hours' immersion. The results of insulation test at different temperatures to be reduced to a basis of 60 degrees F. (15.5 degrees C.) by using the multipliers in the following table:—

Temp. Degs. F.	Multiplier
50-52	.69
53-55	.78
56-58	.88
59-61	1.00
62-64	1.12
65-67	1.27
68-70	1.43
71-73	1.60
74-76	1.81
77-79	2.04
80-82	2.29
83-85	2.58

e. Thickness of insulation, voltage tests and minimum insulation resistance to be in accordance with the following tables. The test voltages are to be for one minute. The insulation resistances are after one minute electrification and at 60 degrees F. (15.5 C.)

Tests on Completed Lengths 0-600 Volt Class
Type Letters R. S.

Size	Thickness in 6ths inches	Megohms per mile. after 12 hrs. immersion	Voltage Test one minute
11	3-64	300	1,500
12	3-64	250	"
10	3-64	225	"
8	3-64	200	"
6	1-16	200	2,000
4	1-16	150	"
2	1-16	125	"
1	5-64	150	2,500
0	5-64	125	"
00	5-64	125	"
000	5-64	100	"
0000	5-64	100	"
225,000 c.m.	3-32	100	3,000
300,000 "	3-32	100	"
400,000 "	3-32	100	"
500,000 "	3-32	100	"
600,000 "	7-64	100	3,500
700,000 "	7-64	100	"
800,000 "	7-64	100	"
900,000 "	7-64	100	"
1,000,000 "	7-64	100	"
1,250,000 "	1-8	100	"
1,500,000 "	1-8	75	3,500
1,750,000 "	1-8	60	"
2,000,000 "	1-8	50	"

Classes.

i Tests on completed lengths 601 to 7,000 volt.

Max. Operating Voltage
1,500 V. Type Letters R. S.—15

Size	Thickness in inches	Ins. Res. Meg.	Volts Test
B. & S. gauge			
14-8	1-16	600	4,000
7-2	5-64	300	"
1-0000	3-32	200	"
225,000-500,000 c.m.	7-64	175	"
525,000-1,000,000 c.m.	1-8	150	"
Over 1,000,000 c.m.	9-64	100	"

Max. Operating Voltage
2,500 V. Type Letters R.S.—25

Size	Thickness in inches	Ins. Res. Meg.	Volts Test
B. & S. gauge			
14-8	3-32	700	6,250
7-2	3-32	350	"
1-0000	7-64	250	"
225,000-500,000 c.m.	1-8	200	"
525,000-1,000,000 c.m.	9-64	175	"
Over 1,000,000 c.m.	10-64	125	"

Max. Operating Voltage
3,500 V. Type Letters R. S.—35

Size	Thickness in inches	Ins. Res. Meg.	Volts Test
B. & S. gauge			
14-8	4-32	850	8,750
7-2	4-32	450	"
1-0000	4-32	300	"
225,000-500,000 c.m.	9-64	225	"
525,000-1,000,000 c.m.	10-64	200	"
Over 1,000,000 c.m.	11-64	150	"

Max. Operating Voltage
5,000 V. Type Letters R. S.—50

Size	Thickness in inches	Ins. Res. Meg.	Volts Test
B. & S. gauge			
14-8	6-32	1,000	12,500
7-2	6-32	650	"

1-0000	6-32	450	"
225,000-500,000 c.m.	8-32	300	"
525,000-1,000,000 c.m.	6-32	225	"
Over 1,000,000 c.m.	7-32	175	"

Max Operating Voltage
7,000 V. Type Letters R. S.—70

Size	Thickness in inches	Ins. Res. Meg.	Volts Test
B. & S. gauge			
14-8	8-32	1,200	17,500
7-2	8-32	800	"
1-0000	8-32	550	"
225,000-500,000 c.m.	8-32	400	"
525,000-1,000,000 c.m.	8-32	275	"
Over 1,000,000 c.m.	9-32	200	"

g. All physical tests to be made at a temperature between 60 degrees and 90 degrees Fahrenheit. All test samples to be kept at a temperature within this range for at least two hours before the tests are made.

1. The rubber compound or other approved insulation must be sufficiently elastic to comply with a test made as follows:—A sample of wire about 20 inches long shall have the braid and insulation removed for about 2 inches at each end, leaving the braid and insulation on balance of sample. One end of the bare copper should be fastened to a clamp on a shaft of the diameter given below, and a weight as given below attached to the other end of the bare copper wire. The shaft shall then be revolved ten times in ten seconds, wrapping the sample in a close wind around the shaft. With the tension left on the sample, it should then be immersed in water for 24 hours, immediately after which it should, while still immersed, be subjected to 1,500 volts alternating current for 1 minute.

B. & S.	Diam. of shaft	weight 10 lbs.
No. 14 wire	170 mils	
12 "	190 "	" 10 "
10 "	275 "	" 12 "
8 "	275 "	" 15 "

2. Any rubber compound used as insulation shall be tested for permanent set, elongation and tensile strength as follows:—

New Wire.—A test piece taken from the wire, having insulation less than five sixty-fourths inch thick, shall have marks placed 2 inches apart, and shall be stretched longitudinally at the rate of 12 inches per minute till the marks are 5 inches apart, and then be immediately released and a measurement taken 30 seconds thereafter, when the distance between the marks must not exceed 2.5 inches. The test piece shall then be stretched until the marks are 6 inches apart before rupture. The tensile strength shall not be less than 400 lbs. per square inch, calculated upon the original cross section of the test piece before stretching.

Test pieces from wire having insulation five sixty-fourths inch thick or over shall be tested in a similar manner, but shall be stretched to 4 inches instead of 5 inches, and must not break until stretched 5 inches, and shall have a tensile strength of 400 lbs. per square inch.

Wire tested at any time up to one year from date of manufacture.—A test piece taken from wire having insulation less than five sixty-fourths inch thick shall have marks placed 2 inches apart, and shall be stretched longitudinally at the rate of 12 inches per minute till the marks are 4 inches apart, and then be immediately released and a measurement taken 30 seconds thereafter, when the distance between the marks must not exceed 2.5 inches.

Test pieces from wire having insulation five sixty-fourths inch or over shall be stretched to 3½ inches instead of 4 ins.

h. All of the above insulations must be protected by a substantial braided covering, properly saturated with a pre-

servative compound. This covering must be sufficiently strong to withstand all the abrasions likely to be met with in practice, and must substantially conform to approved samples submitted by the manufacturer.

i. Five chemical tests shall be made of the rubber compound as follows: Acetone extract, alcoholic potash extract, chloroform extract, ash and total sulphur. The sum total of the results of these five tests shall not exceed 80 per cent. by weight of the total compound. The ash test shall be supplemented by tests to determine the quantity of substances other than vulcanized rubber, which are combustible, but not soluble in acetone, alcoholic potash, or chloroform, and any such substance shall be counted as ash. Tests to be made according to Underwriters' Laboratories specifications.

Lead Covered Wires and Cables for Interior Work Only (Type letters R. S. L.)

j. The thickness of the insulating wall of lead sheath rubber insulated conductors 0-600 volts to be the same as for braided cable, all cables to be covered with a compound filled tape or braid over the insulating wall. If braid is used, it shall be of such a thickness as to increase the required diameter over the insulating wall by at least one thirty-second of an inch, and must comply with the requirements for braid on braided conductors.

If tape is used it must not be less than one sixty-fourth of an inch thick and must lap at least one-fourth of its width. The width of the tape used should not exceed twice the square root of the diameter of the conductor over the insulating wall; i.e., 500,000 c.m. three thirty-seconds rubber, tape not to exceed 2 inches in width; No. 14, three sixty-fourths rubber, tape should not exceed 8 inches in width.

The lead on single conductor cables, 0-600 volt class, sizes 2 B. & S. and smaller, both solid and stranded, to be not less than the thickness of rubber called for by Section e. On larger sizes the thickness of lead to be not less than the thickness of insulating wall, called for, less one sixty-fourth of an inch; i.e., thickness of lead of No. 2, one-sixteenth inch; on 1,000,000 c.m., three thirty-seconds inch. On multiple conductor cables, thickness of lead to be that called for by single conductor, having same diameter over the insulation as the multiple conductor cable has over the bunched insulated conductors.

Rubber insulated and lead sheathed cables, 601 to 7,000 volt classes inclusive (Type letters R.S.L.-15, R.S.L.-25, etc.) shall comply with section f, and the lead sheath shall be the same as called for in 0-600 volt class, having same diameter under the lead as 601-7,000 volt conductor.

(Electrical test on finished leaded cables the same as on braided.)

Mr. Julian C. Smith, superintendent of the Shawinigan Water & Power Company, and Mr. John Murphy, electrical engineer of the Department of Railways and Canals, were among the Canadian representatives who, with a number of members of the American Institute of Electrical Engineers, have just paid a visit to the Panama Canal. The party travelled via New Orleans. Mr. Smith was absent from Montreal for a month. The party inspected the two big power stations on the canal.

Argument for and against the power scheme of the Isle au Heron Development Co. whose power site is just above Montreal was heard recently before the Hon. Mr. Monk, Minister of Public Works. In view of representations made, the Minister announced that nothing in the way of approval of the company's plan or authorization of its undertaking will be done until the departmental engineers or the commission on St. Lawrence water power developments can report fully in the matter.

Personals

Mr. R. A. Sarrow has been appointed sales manager in the city of Winnipeg's light and power department.

Mr. H. G. Matthews has been appointed general manager of the Quebec Railway, Light, Heat & Power Company.

Mr. J. G. Glassco has been appointed general manager of the Winnipeg municipal electric system, succeeding Mr. Rossman, resigned.

Mr. Stanley L. B. Lines, Canadian manager, Chamberlain & Hookham, meter manufacturers, has taken offices in the new Kent Building, Richmond and Yonge streets, Toronto.

Mr. A. J. McDonald, superintendent of the city street car service of the Quebec Railway, Light, Heat and Power Company, has resigned to accept a position in the United States.

Mr. Alfred Landau, president of the Canadian Carbon Company, Limited, of Toronto, is at present in Florida, where, accompanied by Mrs. Landau, he is spending a month holidaying.

Mr. D. H. Bowen, late manager of the Canadian Pacific Telegraph office in London has been promoted to the position of assistant superintendent for Ontario with headquarters in Toronto.

New Books

Radio-Telegraphist's Guide and Log-Book,—by W. H. Marchant; Whittaker & Company, London, publishers. Price 4s. 6d. net. A manual of wireless telegraphy for the use of operators. The first portion of the book is devoted to a description of apparatus used in radio-telegraph installations. Then comes a description of some of the leading systems, including the Marconi and United Wireless Companies. A later chapter is devoted to Brown's telephone relay; another chapter to measurements; another to the regulations and instructions for the working of ships and stations licensed by the Postmaster General. A number of appendices dealing with various practical subjects complete the list. Numerous good illustrations and a goodly number of log forms add greatly to the value of the book.

Engineering as a Vocation,—by Ernest McCullough, C.E.; David Williams Company, New York, publishers. A book written by a practical engineer of long standing with the idea of placing the prospects of success in the various phases of engineering work a little more clearly before the average student. It is said in the preface that it is written for the information of parents in selecting a career for their sons. The author expresses the belief that technical journals and other publications have given too roseate a view of the chances of success and of high salaried positions and such as actual conditions do not justify. The book will undoubtedly be read with profit by parents and prospective engineers.

Telephony,—by Samuel G. McMeen, Mem. A.I.E.E., and Kempster B. Miller, Mem. A.I.E.E.; The American School of Correspondence, publishers. A comprehensive and detailed exposition of the theory and practice of the telephone art. The book comprises some 950 pages of carefully prepared, well illustrated matter dealing with every phase of telephone installation and operation. The subject is treated from the foundation up, so that learners will not find it too technical. On the other hand general principles are explained in sufficient detail to be of value to the most experienced telephone engineer. This book is a distinct addition to telephone literature and undoubtedly brings the science up-to-date as no other recent work has done.

Development Conditions at Niagara

An Extract from the Report of Arthur V. White, M. E., to the Conservation Commission of Canada Showing the Necessity for Conserving Niagara's Waters

From an economic standpoint the power possibilities of the Niagara falls and river constitute to-day the most important hydro-electric power site in the world. The process of depletion of the known coal fields of the United States—especially the anthracite coal beds of Pennsylvania—will tend, in the near future, to cause the aesthetic claims made on behalf of the scenic beauty of the Niagara falls and rapids to yield before possible aggressive demands made by companies to utilize the waters discharging from Lake Erie. It is noteworthy that many of the charters already granted companies for power development are kept alive, even though, as yet, no construction works have been begun.

Marvellous is the regulated flow of water from the Great Lakes, as it exists under the laws of the Creator. Referring to this natural regulation of flow, the Joint International Waterways Commissioners, in 1910 reported that "no work of man ever approached or ever will approach, this perfection of regulation," and they add that man "may disturb it, making it less uniform." The conservation, therefore, of this natural uniformity of flow is a matter for national concern, and the public at large should have an intelligent appreciation of the menace that exists in unduly utilizing the waters of the Great Lakes system whether at Niagara, the Long Sault Rapids, Cedar Rapids, or elsewhere, for purposes of power development.

The time is coming when people will see that the amount of water which would naturally course the entire length of Niagara's bed, and which may, even temporarily, be diverted for power purposes without proving to be a serious menace to Nature's balancing of the levels of the Great Lakes, is much smaller than is popularly supposed. Some exceptional natural phenomena already seem to be manifesting themselves in the Great Lakes system. What may be the results when even all the water already authorized for diversion is in service, the future alone will disclose. It would be a wise precaution, when granting water privileges on a river, say, like the Niagara River, if the governments interested reserved the power to demand that waters diverted from a river must, if so required, be temporarily returned to the river. Such a course would increase the flow and thereby assist in averting critical conditions that might arise, as, for example, a dangerous ice jam which might be broken up by the agency of an increased flow of water taking place during the formative stages of the jam.

Physical Factors of Lake Erie

The Niagara River drains an area, including lake surface, of 254,708 square miles. The lake surface area is 87,845 square miles, making the ratio of lake to drainage area as 1 to 2.9.

In the Great Lakes system there is a regular annual variation in levels due to difference in rainfall, evaporation, and run-off, the water level being highest in mid-summer and lowest in mid-winter. The levels are affected also by the greater or less severity of the winter and by the consequent greater or less decrease in the discharging capacity of the outlets by ice. The interval of time required for an increasing supply to show its effect upon the level of Lake Erie is about 76 days, and for a decreasing supply it is about 132 days.

The extreme variation of level of Lake Erie during the period 1860-1907 is 3.89 feet, with a maximum range in one

year (1892) of 2.28 feet, a minimum range in one year (1895) of .87 feet, and an annual average range of 1.56 feet.

The amount of water which Lake Erie discharges through the Niagara River is a variable quantity and depends upon the elevation of the water surface, or, as it is termed, the stage, of the lake. For the Great Lakes system it is customary to give the stages of the respective bodies of water above a fixed datum. Mean tide water at New York is the datum usually selected.

Consider an illustration. A variation in the stage of Lake Erie of a single foot, at Buffalo Lighthouse, Buffalo, corresponds to a difference in the rate of the discharge from the lake of from twenty to twenty-five thousand cubic feet of water per second. The increments of discharge per foot change in stage vary for different sections of the river. They are expressed in cubic feet per second, at Buffalo Lighthouse, as follows:

Stage	Increment in C.F.S.
572.67 (mean)	23,400
570-571	19,600
571-572	21,400
572-573	23,200
573-574	21,100

The knowledge such data conveys is, that if the water level of Lake Erie, at Buffalo Lighthouse, for example, is 570 feet above mean tide level at New York, and the level rises to 571 feet, then, the Niagara River will discharge at the rate of 19,600 cubic feet of water per second more than it was discharging at the 570 foot stage. If, next, the stage rises from 571 to 572 feet, then the discharge rate becomes 21,400 cubic feet per second greater than it was at the 571 foot stage.

The bearing which such facts have upon the question of power development is, that the horse-power available at any specified time, at, say, Niagara Falls, depends upon the quantity of water flowing in the Niagara River at that time, and, as has just been pointed out, this quantity depends upon the stage, or level, of the water in Lake Erie.

In addition to the monthly, yearly or other periodic changes, variations in the level of the lake's surface, due to winds and to change of barometric pressure, are frequent and irregular, and at times violent. Variations of more than six inches are very common, often occurring hourly for many hours in succession, while variations of two or three feet within an hour are not uncommon. It sometimes happens that the stage varies as much as seven or eight feet in one day. Storms raise the water level at Buffalo several feet higher than normal, and lower it at Amherstburg, by a like amount; the difference of level between the two ends of the lake in extreme cases having been as great as fifteen feet.

Discharge of Niagara River

The discharge of the Niagara River has been determined by measurements taken at the International Bridge located at Buffalo, N.Y., and at a point about 1,800 feet down stream at the "Open Section." Measurements were begun in 1897 and are being carried on by the engineering staff of the United States Lake Survey. The maximum monthly mean discharge from Lake Erie, 257,800 cubic feet per second, equivalent to a depth of 2.44 feet on the lake, occurred in June, 1876. The minimum, 168,700 cubic feet per second, equivalent to a depth of 1.60 feet on lake surface, occurred in

March, 1896. The average discharge of the Niagara River during the period 1860-1907 was 212,200 cubic feet per second.

From 1860 to 1907 the greatest excess average for any one month was for June, 1876, being 45,600 c.f.s., or twenty-one per cent.; the greatest excess average for any one year was for 1876, 26,500 c.f.s., or twelve per cent.; the greatest deficiency average for any one month was for March, 1896, being 43,500 c.f.s., or twenty-one per cent.; the greatest deficiency average for any one year was for 1895, being 31,800 c.f.s., or fifteen per cent.

Power Possibilities of Niagara Falls

Many statements of a misleading character—no doubt, sometimes, through ignorance—have been published regarding the water-power possibilities of Niagara Falls. Theoretical quantities of available horse-power have been presented to the attention of the public, while quantities of actually developed horse-power have been the units in which power companies have required their concessions from the government. Comparisons should be made with corresponding units.

Under conditions of average discharge the Niagara River, from Lake Erie to Lake Ontario, with its total fall of about 325 feet, would, theoretically yield about 8,000,000 horse-power. The fall in the Niagara River from Lake Erie to the surface of the water below the Falls is about 226 feet, and from the head of the rapids above the Falls (forebay of the Ontario Power Company's head works) to the foot of the Falls, about 212 feet. The Ontario Power Company operates under a normal head of about 180 feet; consequently, this company utilizes about eighty-five per cent. of the available head of 212 feet. This is a larger percentage of the total head than is utilized by other companies at Niagara. The combined efficiency of the turbines and generators constituting the large units at the Falls is about eighty per cent., so that only eighty per cent. of the eighty-five, which is sixty-eight per cent., of the possible development, is available as developed electrical horse-power. Hence, one of the first things we have to do is to cut the theoretically possible horse-power down over thirty per cent.

Again, in estimating possible available h.p., it is customary to base the estimates upon the minimum discharge, or flow. Such is the basis employed for the estimates given in the Hydro-Electric Power Commission and many other reports. Now, if the power at Niagara Falls is considered on this basis of minimum monthly discharge, then, a further reduction of twenty per cent. must be made from the horse-power totals customarily given for the Falls based upon average conditions of flow. Hence, reducing our sixty-eight per cent. by twenty per cent., we find that the developed horse-power possibly available at the Falls will be about fifty-five per cent. of the total theoretical horse-power estimated for average conditions.

It must not be forgotten, either, that it would never be possible to use all the water of the river. The ice must go by way of the Falls and not by way of the water-wheels. Just how much water must be reserved to go over the Falls in order to prevent the ice from lodging above the Falls and creating disastrous ice jam conditions, would be difficult to state. Possibly the diversions of water at present authorized may yet be found, when all is in service, to encroach upon the limits of safety.

Canada's Share Nearly Half Gone

Considered, therefore, in the most favorable light of the facts just mentioned, and from the viewpoint of the amounts of power obtained from present Niagara developments, all the mean low-water discharge, with the 212 feet available at Niagara Falls, would give an estimated amount of about 2,765,000 h.p. Canada's share of this would be 1,382,500 h.p.

Let us, however, view the situation from another stand-

point. It has been ascertained by special investigations made of existing Niagara plants by the United States Government, that it takes about .075 of a cubic foot of water per second, to actually develop one horse-power. Even on this basis, the low-water discharge of 168,700 cubic feet per second would yield at the Falls about 2,250,000 h.p., of which Canada's share would be 1,125,000 h.p. Franchises have already been granted, and plants partially completed, for the development on the Canadian side of the river of about 450,000 h.p. In other words, instead of 'millions' of horse-power being available, as has been sometimes stated, it appears that about half, and by all odds the better half, of Canada's usable share of Niagara Falls power has already been placed under private control; and, as just intimated above, circumstances attendant upon the use of all the waters now authorized may show that ice, and other conditions, preclude the use of a further proportion of Canada's equity in the waters at Niagara Falls.

We have not been dealing with theoretical quantities nor with estimates of possible actual quantities, but with quantities based upon measurements of flow and upon the percentage of the available power which the companies, who have installed operating power plants, have used under the best expert engineering advice obtainable.

Power of the Lower Niagara River

Let us briefly consider the power possibilities of the lower Niagara River. From the head of the rapids below the Falls to the mouth of the gorge in the river there is a fall of about 94.5 feet. This is about forty-five per cent. of the head available at the locality of the Falls. Assuming that as great a proportion of the available power of the rapids is used as of the power theoretically available at the Falls, and assuming further that all the water of the river is diverted, then we would have about 1,000,000 theoretical horse-power. In the portion of the river in which the fall is greatest; viz., from the head of the rapids below the Falls to the foot of Foster's flats, there is a drop of 78.5 feet. This is thirty-seven per cent. of the head available at the Falls. Upon assumptions corresponding to those just made above, the river would yield about 830,000 h.p., of which Canada's share would be 415,000 h.p.

Obviously the rights to the first 10,000 or 20,000 cubic feet of water diverted from the lower Niagara River are very much more valuable, considered from the physical standpoint, than the rights appertaining to any diversions that may subsequently be authorized.

The Lower Niagara River Power and Water Supply Company, incorporated under the laws of the state of New York and empowered by the State "not to take more water than shall be sufficient to produce 200,000 effective h.p.," has applied to the United States Federal Government for authority to utilize an amount of water not exceeding 40,000 cubic feet per second from the lower Niagara River. Reporting upon this application, the International Waterways Commission, in its Report to the United States Secretary of War, states that

"It is our opinion that about 40,000 cubic feet per second can be diverted without perceptible injury to the rapids, and that any amount greater than that will approach the danger line more and more nearly, according to its volume. We therefore recommend that no more than 40,000 cubic feet be diverted on both sides of the river taken together."

Theoretically, this recommended diversion of 40,000 cubic feet per second with the head of 94.5 feet would yield about 430,000 h.p., of which Canada's share would be 215,000 h.p. With a total head of 78.5 feet to the foot of Foster's flats, 20,000 cubic feet per second would yield, theoretically, about 180,000 h.p. Owing to the difficulties of hydraulic construction and the large fluctuations in head which occur in the

lower river, it would be difficult to determine just what proportion of the theoretical quantities could be obtained from a diversion on the Canadian side of 20,000 cubic feet per second.

Power sites on the rapids below the Falls are much inferior to the power sites in the vicinity of the Falls. The Commissioners of the Queen Victoria Niagara Falls Park had a report made as to the possible power sites on the Canadian side of the lower Niagara River. This report shows a number of possible power sites using the shortest possible tunnel routes, but the estimated total of all the reported sites is considerably under 50,000 h.p.

Summary

In conclusion it may be said that under present methods of development, and assuming all the water passing over the Falls to be diverted for power purposes, Canada's share of the power may be under 1,000,000 h.p. Below the Falls, using all the water and the total head of 94.5 feet, the lower river would yield for Canada's share about 450,000 h.p. These quantities are for the mean low-water discharge; for average conditions of flow they might be increased about twenty-five per cent.

If either Canada or the United States should first exercise its right to generate 500,000 h.p. from its share of the Niagara waters, then physical conditions might probably prevent the other country from actually developing all told half a million horse-power from the remaining available waters at Niagara Falls.

Many municipalities of Ontario are now dependent for their supply of electricity upon a single plant at Niagara Falls. Any remaining power site there, or upon the Niagara River, or westward upon the Niagara escarpment, should never be permitted to be developed, except upon such terms and conditions as will absolutely and perpetually provide an alternative source for a cheap and sufficient supply of electrical energy for the municipalities of Ontario that are dependent for their electricity upon Niagara power. This provision should be made in view of a possible temporary disabling of the plant upon which the municipalities are now dependent, in view, of the future expiration of present contracts, and in view, also, of the increased light, heat and power demands of the future.

CENTRAL STATION ADVERTISING

The owners of light and power plants gain much by publicity—Some of the methods used

In our February issue we called the attention of our central station readers to the advantages that should follow an interchange of ideas in advertising methods and suggested

E L E C T R I C I T Y
USE
E L E C T R I C I T Y
USE

that if any new methods of giving publicity to the value of electrically operated apparatus, thus leading to exten-

sion of the station load, should be sent in to us, we would give them all possible publicity.

We are in receipt of some very interesting matter from Mr. I. H. Wright, manager of the North Bay Light, Heat & Power Company, who has been unusually successful in building up a satisfactory station load and of keeping his constituents in sympathy with central station operations. We reproduce herewith two of the ideas. The first illustration is a reproduction of the back of letters used by this company, drawing the attention of everyone of their correspondents to the magic word "electricity," and from the central station viewpoint, the still more magic word, "use." The other illustration represents a poster which the North Bay company used recently with highly gratifying results.

We are sure that the ideas sent in by Mr. Wright will

Finished Houses Old Houses

WIRED FOR ELECTRIC SERVICE

25 %

below Contractor's Prices for Wiring till

March 31st, 1912

We will stand between You and the Wiring Contractor
and Save You His Usual Profits.

You Pay Us—We Pay the Contractor

We will make the Payments Easy if you so desire. You may pay \$2.50 when contract is signed, and \$2.00 per month thereafter.

Fill in the Coupon or Call at the office. Send your Name in anyway. Our Solicitor will call on you and tell you what the Wiring will Cost.

North Bay Light, Heat & Power Co.
Limited

COUPON

To The North Bay Light, Heat & Power Co.
Limited

Without placing me under any obligation whatsoever,
I desire you to have an estimate made of the cost of
wiring my residence.

NAME

ADDRESS

prove valuable to other operators in the same work, and as we have no doubt there are many other good schemes in use throughout Canada we ask your further co-operation.

Want Charter Renewed Once More

The Georgian Bay Canal Company, who hold a charter in connection with the construction of dams along the Ottawa River and the development of water powers in connection therewith have applied to the Dominion Parliament for a renewal of this charter. Vigorous protests were made on behalf of the Ontario Government against the giving away of any of Ontario's water rights with the result that the matter has been referred to a sub-committee who will redraft the charter in an attempt to protect the rights of the two provinces concerned.

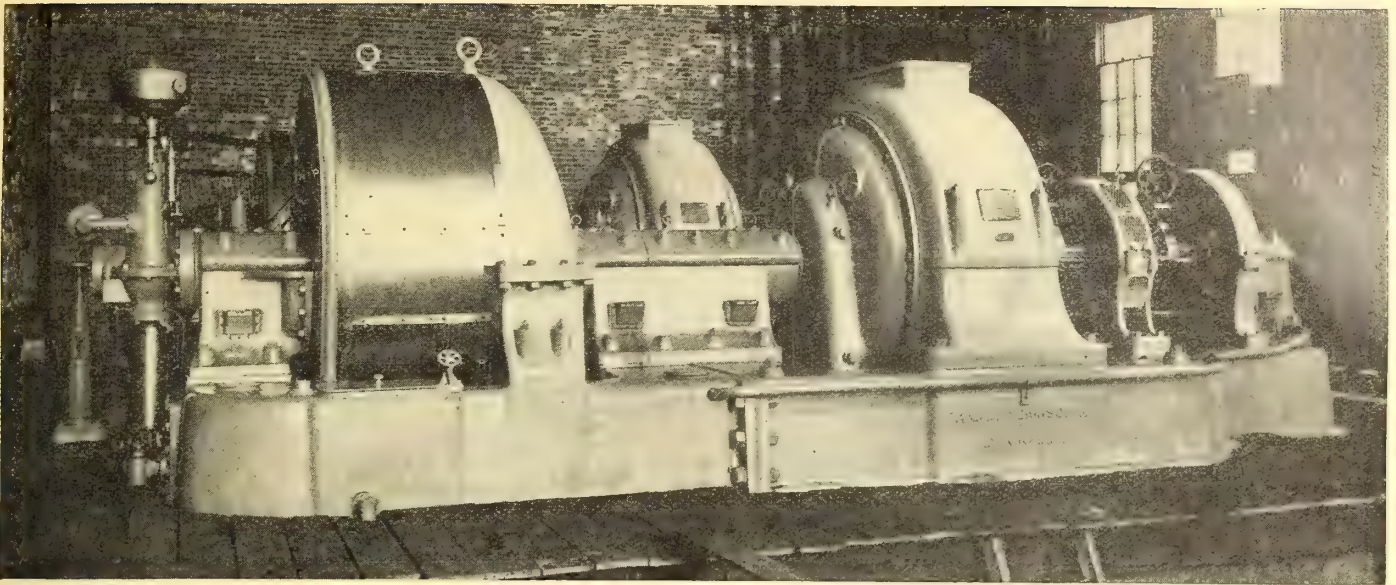


Fig 1—Two d.c. Turbo-Generators recently installed for the Nova Scotia Steel and Coal Company

Nova Scotia Steel and Coal Equipment

Generators and Turbines of British Manufacture—Unusually High-Speed Characteristics — Now Adding a 950 kv. a. 3600 r. p. m. Alternator

The photograph shown herewith, Fig. 1, illustrates two direct current turbo-generators recently installed in the plant of the Nova Scotia Steel & Coal Company. Each of these generators has an output of 500 kw. at 200 to 250 volts when running at 1750 r.p.m. The generators are direct-coupled to exhaust steam turbines. The electrical equipment was installed by the Siemens Companies and the turbines by Messrs. Daniel Adamson Co., Manchester. The above installation has been operating about 5 months and, it is claimed, is giving entire satisfaction.

The following details in connection with the construction of the generators will be of interest. All parts of the turbo-generators with the exception of the commutator are fully enclosed in a substantial cast-iron shell having a spe-

cial air intake and air outlet arranged in the magnet frame casing, see Fig. 1. A continuous current of cool air is drawn through the machine by the action of the ventilating ducts

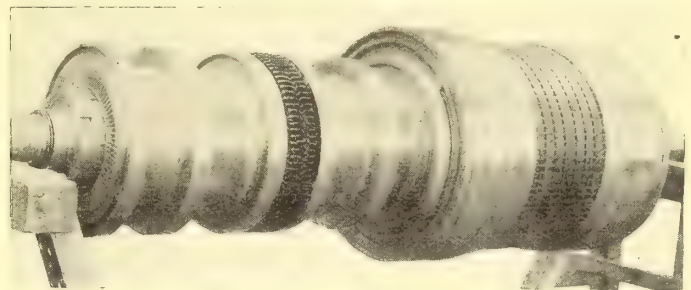


Fig 3—Specially Constructed High Speed Armatures

in the armature and by means of a special fan formed in the armature.

The fully enclosed construction of these generators makes them very silent in operation and further enables the ventilating air with which they are supplied to be drawn from the coolest available source (if necessary from outside the engine room) and also enables this air to be filtered.

The field system is provided with commutation poles and, in addition to these, compensating windings are arranged in the pole faces to neutralize the effect of field distortion due to the armature re-action. Fig. 2 shows this construction plainly.

The armatures are specially constructed to withstand the stresses due to high speed of rotation, the overhang at each end of the core being held in place against the action of centrifugal force by bronze and steel winding covers shrunk on over an insulating layer of presspahn, Fig. 3. These covers are machined inside and out and produce an exceedingly sound mechanical construction for the armature, the conductors being held in place in the most efficient manner possible.

The commutators are ventilated by the provision of an air channel in each individual segment, (each segment be-

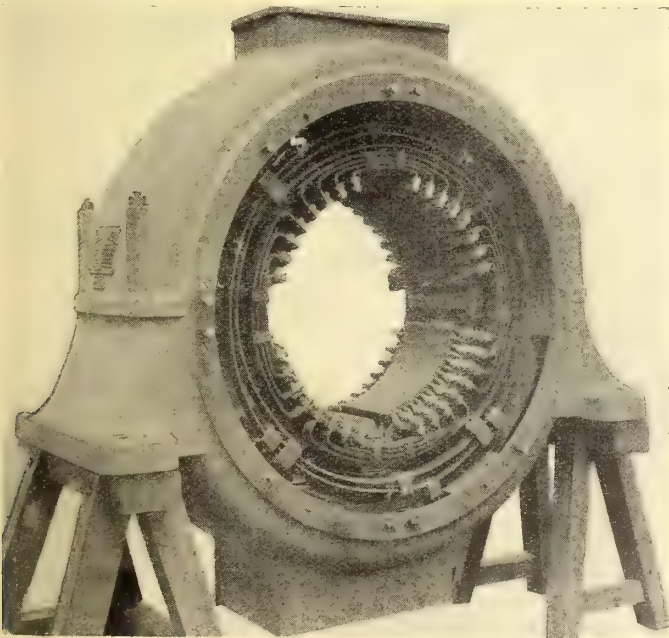


Fig. 2. — Note Compensating Windings in the Pole Faces

ing formed of two parts which, after having a portion milled out, due allowance being made for wear and strength, are placed together) the cooling air being drawn through these channels by means of a fan formed in the commutator construction. Fig. 3 will give a good idea of the special construction of this direct current turbo-generator armature



No. 4—Standard Motor, Coils heavily braced

and the air channels in the segments can be clearly seen on the left side of the commutator in this cut.

The Nova Scotia Steel & Coal Company has also just placed an order for another similar unit, but for alternating current, namely, a 950 kv.a., 3-phase, 3200 volt, 60 cycle, 3600 r.p.m., Siemens turbo-generator. This generator is also of the fully enclosed type mentioned above. A continuous current of air is forced through the stator in a direction parallel to the axis of the shaft and by this system of ventilation the hottest part of the machine is at the end remote from the air inlet and is readily accessible for thermometer measurements, and not, as in radially ventilated

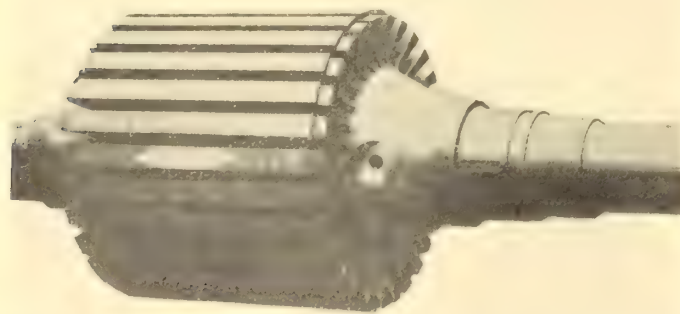


Fig. 5—Rotor core forged in one piece with shaft

machines in the middle of the machine which is inaccessible. Fig. 4 shows a standard stator and attention is drawn to the heavy bracing of the coils.

Another noticeable item about this a.c. generator is its high rotation speed. Due to this requirement the rotor core will be of solid construction and forged in one piece with the shaft, Fig. 5. The necessary slots to take the conductors are milled out and a further narrower space is

milled out under these, thus creating a space for axial ventilation but leaving sufficient shoulder to take a support under the winding. The windings consist of former wound coils of flat copper strip. These strips are turned on edge where they overhang. Metal keys secure the windings in the slots and end connections have substantial bronze and steel winding covers, shrunk on over a layer of presspahn.

The Siemens Company is also supplying the switchboard for this latter equipment which consists of generator and feeder panels. The steam turbine will be supplied by Messrs. Fraser & Chalmers, England, through their representatives, Messrs. Mussens Limited, of Montreal.

Calgary Electric Light & Power Department

Commissioner A. G. Graves, of Calgary, has just issued his report for 1911. Calgary is justly looked upon as one of the most successful examples of municipal ownership in Canada. The following extracts from this report are given to indicate the business-like methods followed. The Commissioner's remarks with reference to the necessity of establishing depreciation, sinking, etc., funds, are especially worthy of note:—

"Early in the year active operations were begun on the construction of a new power station in Victoria Park, and on May 15th hydro-electric power was delivered in Calgary from the Calgary Power Company's plant on the Bow River, and the old power station on Ninth avenue was closed for power production purposes, the two larger of the four engines being removed to the new station. With the installation of the new 2,000 h.p. steam turbine, we now have a capacity of 3,000 h.p. a.c. for light and power purposes and 1,500 h.p. of d.c. for street railway purposes. At the present time we are taking from the Calgary Power Company 3,000 h.p., more or less. Our auxiliary plant is kept under steam and we are making a practice of taking about 900 h.p. off the peak loads for a short time during the evening and thus materially reducing our expenditure on power account. With the installation of another steam turbine of 2,500 h.p. capacity, the city will then have a "Stand By" plant of over 6,000 h.p. a.c., which puts the city in a most favorable position, should any serious interruptions occur to the water power plant.

"With the rapid development of this city I estimate that 6,000 to 7,000 h.p. will be required by next November to meet the demands. As there is a limited amount of power available at the present site on the Bow River, it is necessary that the city should investigate other sources of power. With the above end in view I intend to at once take up the question of power production by means of natural gas.

"The finances of the department are in a healthy condition. On December 31st, 1910, there was a debenture debt of \$559,000, on which the plant paid interest to sinking fund and five per cent. depreciation during the year 1911, together with all fixed charges, making a total expenditure of \$225,651. The revenue received was \$264,731.91, leaving a gross balance of \$9,080.87. In the accumulated savings account, meter and depreciation funds, there will be as follows: Savings account, \$63,808.19; meter account, \$10,806.53; depreciation account, \$63,444.05; making a total accumulated fund of \$138,058.77.

"In regard to the depreciation fund, the wisdom of establishing such a fund is now apparent, as a portion of the amount can very well be used during 1912 for legitimate purposes for which the fund was established. The same remarks can also apply to the meter fund, which was established for repairs, renewals and government inspection fees and is in reality a depreciation fund. The city will make no mistake in maintaining the depreciation fund, as it places the department in a foremost position in the successful operation of municipal utilities.

The Month's Activities in British Columbia

Electrical Sawmill for E. H. Heaps & Co., Ltd.

A notable sawmill installation is now being made at Ruskin, B.C., for E. H. Heaps & Co., Ltd., Vancouver. Some twelve months ago the old sawmill operated by E. H. Heaps & Company was destroyed by fire, and immediately plans were begun for the erection of an up-to-date modern electrically driven sawmill. Considerable time was spent by Mr. Heaps in personally visiting a number of the larger electrically driven sawmills both in Canada and the United States, and finally a very comprehensive scheme was arranged for a new mill at Ruskin, and an order placed with Allis-Chalmers-Bullock, Ltd., at Vancouver for the entire equipment.

This mill will have a daily capacity of 200,000 feet and the power will be supplied by a 1600 kilowatt Allis-Chalmers turbo-generator, practically all of the mill machinery being driven by individual motors, and including the following:

Set Works on L.H. Side .. .	7½ h.p. motor at 1200 r.p.m.
10-ft. Band Mill .. .	300 h.p. motor at 900 r.p.m.
Rolls and Transfer Skids ..	10 h.p. motor at 1200 r.p.m.
Transfer, Swing Saw & Live Rolls .. .	40 h.p. motor at 1200 r.p.m.
Conveyor .. .	10 h.p. motor at 900 r.p.m.
Conveyor .. .	10 h.p. motor at 900 r.p.m.
Rolls and Transfers .. .	20 h.p. motor at 1200 r.p.m.
Rolls and Transfers .. .	20 h.p. motor at 1200 r.p.m.
Transfers .. .	30 h.p. motor at 1200 r.p.m.
Rolls, Transfers, etc. .. .	40 h.p. motor at 1200 r.p.m.
Conveyor .. .	10 h.p. motor at 1200 r.p.m.
Conveyor .. .	10 h.p. motor at 1200 r.p.m.
Main Conveyor .. .	20 h.p. motor at 1200 r.p.m.
Conveyor to Burner .. .	10 h.p. motor at 1200 r.p.m.
Rosser on L.H. Side .. .	7½ h.p. motor at 1200 r.p.m.
Log Jack .. .	30 h.p. motor at 1200 r.p.m.
Edger and Feed Works ..	200 h.p. motor at 1200 r.p.m.
10 Saw Slab Slasher .. .	75 h.p. motor at 900 r.p.m.
23 Saw Overhead Trimmer ..	50 h.p. motor at 720 r.p.m.
Rolls Behind Trimmer ..	15 h.p. motor at 1200 r.p.m.
Trimmer Saws .. .	20 h.p. motor at 1800 r.p.m.

The complete equipment for the planing mill has not been entirely laid out, but orders covering this further machinery will be placed very shortly. Power will be furnished by the Western Canada Power Company.

Railway and Light Progress in Nelson

At a meeting of the shareholders of the Nelson Street Railway Company, held during January, J. E. Taylor, president of the company, reviewed the history of the concern in an interesting manner, showing how favorably its present compared with its past. Receipts during the past six months have been almost as great as the whole of 1906, and with rolling stock in first-class condition the prospects for 1912 are exceedingly bright at present. Mr. Taylor declared that there was every reason to expect the railway would be paying dividends at no distant date, and warmly eulogized E. C. Ingram, the general manager, who had always proved himself a zealous worker in the interests of the company.

Herbert P. Thomas, recently appointed city electrical engineer at Nelson, in a report to the council declared his strong opposition to the flat rate system of charges for electric light service, declaring it to be both extravagant and wasteful. Under that plan the city is only receiving payment for 85 per cent. of the light it supplies, and 45 to 60 per cent. of the power and heating load in the residential

sections, while 25 per cent. of the present light supply is being stolen and approximately 40 per cent. of the toasters, irons, etc., in use are not being paid for. Mr. Thomas declares that unless the meter system is adopted a third unit will be necessary at the power plant. The cost of metering the whole city is placed at \$15,000 and Mr. Thomas advocates an expenditure of \$5,000 yearly until all meters have been installed.

Point Grey Refuses Long Term Franchise

At the municipal elections held during January, Point Grey ratepayers decided against the re-submitted British Columbia Electric Railway franchise for a term of 40 years, which the Court of Appeal said was invalid because it had not been voted upon by the electors. Practically the same franchise was carried by the electors a year ago last July, but later alterations had been made by the council. It was for the failure to re-submit it to the people after the alterations that the court declared it invalid. Following on the refusal of the British Columbia Electric Railway to operate its lines in the Point Grey district pending a settlement of the transportation situation, the Point Grey Municipal Council recently passed a resolution to prevent the company using the Alma Road switch at the end of the Fourth Avenue city line, part of the switch being located in Point Grey territory. That the council is prepared to take legal steps to enforce their order is evidenced from the fact that a communication was received from the municipal solicitor advising that the municipality had the power to compel the company to remove its rails within the district providing the company was given reasonable notice.

New Lighthouse for the B. C. Coast

The Dominion Government Marine Department has let a contract for construction of a concrete lighthouse at Sheringham Point, on the northern shore of Juan de Fuca Strait. Lighthouses are already established at Carmanah and Otter Point, and with the new one in operation the entrance to the Straits will be made much more safe in thick weather. The lighting apparatus consists of a lamp, which gives a bare flame equalling 2500 candles. The cut glass lens is six feet in diameter. The four sections of the lens are bolted together and fastened to a cast-iron table. The lens and table, weighing together approximately seven tons, are revolved by clockwork. To reduce the friction caused by this enormous weight revolving, the lens and table rest in a cast iron bath filled with mercury, which floats the entire weight so it can be turned with very small energy. The complete revolution will be once every 20 seconds, and give four flashes during that time. The same type of apparatus, and of the same size, is now in operation at Pachena, Estevan and Triangle stations, on the west coast of Vancouver Island.

Further Extension Made to B.C.E.R. Auxiliary Steam Plant

The auxiliary steam plant of the British Columbia Electric Railway Company in Vancouver, already consisting of four 2,000 kilowatt Allis-Chalmers turbo-generators, will be further increased immediately, as intimated by the placing of an order with the Vancouver office of Allis-Chalmers-Bullock, Ltd., for a 4500 kilowatt, at 90 per cent. power factor, steam turbo-generator. This unit will have a 50 per cent. overload guarantee and bring the overload capacity of

the steam plant up to 24,000 horse-power, so that for peak loads and emergency occasions this plant will be of great advantage in connection with the main power supply from the generating plant at Lake Buntzen.

Increase in Penticton Rates

Following upon the recent purchase of the Penticton telephone system by the Okanagan Telephone Company, the Penticton manager has announced a raise in the rate on business phones to \$5.00 per month, with a rebate of \$1.00 if paid before the end of the month. Subscribers have protested vigorously, and it is understood a legal aspect to the situation has arisen in the fact that the company hold a franchise for the Okanagan Valley, but do not hold any franchise for Penticton. Therefore, subscribers declare, the new company will not be able to bring about the raise. The telephone company holds, however, that their general franchise covers the two districts, while the local council holds otherwise. The present franchise which the new company purchased has only two years to run, and provides that rates cannot be raised above \$3.00. The council threatens to install a municipal system should the new company persist in its demands.

Attempt to Wreck Pole Line

On the night of Feb. 2nd an attempt was made to wreck one of the poles carrying the Vancouver Power Company's cables from Lake Buntzen generating plant. The point selected was near Capital Hill, in North Burnaby some miles east of the city. A hole had been bored into the pole and a stick of dynamite placed there and exploded, but although the pole was shattered from base to near the top it was held in place by the tension of the wires. It is thought that thieves and yeggmen, now very active in Vancouver, had planned to plunge the city in darkness for a time in order to plunder it at will. Officials of the Vancouver Power Company state that even had their lines been torn down, the auxiliary plant would have enabled the service to be restored in ten minutes.

50,000 h.p. on Willow River

A report has recently been filed at Victoria on the water power of the Willow River, about seventeen miles east of Fort George, B.C. This river is a tributary of the Fraser, entering the latter river some twenty-five miles above the junction of the Nechaco with the Fraser. At the Willow Canyon, located about thirty miles above the mouth of the river, and seventeen miles due east from Fort George, the Fort George Power Co., Ltd., proposes to undertake the work of developing cheap power for manufacturing and other purposes in the future city of Fort George. Several tests have already been made, one at extreme low water last August showing a flow of 250 second feet. According to the report, 40,000 or 50,000 h.p. might be obtained with sufficient storage.

Raising Power Wires Another 25 ft.

A contract for raising the high tension wires of the B. C. E. R. on the government bridge across the Fraser River at New Westminster, has been awarded by the management of the company to a Vancouver firm. Requests for this work, in the interests of the navigation on the river, have been made by the New Westminster Board of Trade, and operations will commence immediately. At present the wires are approximately 200 feet above water level, and it is planned to raise them another 25 feet by increasing the height of the supporting towers. At least two months will be taken to complete the alterations, which involve an expenditure of about \$10,000.

Tramway for North Bank of Fraser

There is every likelihood of the early construction of an electric tramway on the northern bank of the Fraser River between Vancouver and Mission City, by the Western Canada Power Company of Vancouver. There is no doubt that development of the northern bank would be greatly accelerated if transportation facilities, such as would be furnished by an electric tramline, were provided. The proposal that such a line be built was first made by the Vancouver Board of Trade, who have discussed the project with Mr. Wm. McNeill, assistant general manager of the Western Canada Power Company, with a view to the possible construction of the railway by his company.

Time Not Ripe for Government Ownership

The Municipal Committee of the B. C. Legislature intends to look into the matter of the establishment of a government telephone system throughout the province of British Columbia. It is evidently the desire of the Union of Municipalities that such an investigation be held, and that the government undertake the organization of a provincial system, urban and rural if it be found practical and prudent. It is thought the recent statement of Premier McBride, that he hardly thought the time ripe for this government enterprise, was by no means final, and it is therefore quite probable that the government will take up the system.

Current Notes

The London office of the Pacific Cable Board is said to be considering a proposition to close the cable station at Bainfield Creek, on the west coast of Vancouver Island, and shift men and apparatus to Vancouver, where accommodation will be found in the C.P.R. Telegraph office.

As evidence of their appreciation, the finance committee of the city council of Victoria, B.C., have voted the sum of \$500 to City Electrician Hutchinson, who for the past few years has been in charge of the installation of the underground salt water high pressure fire system of that city, the plans for which he also supplied.

The percentage payments made to the city of Vancouver by the British Columbia Electric Railway during 1911 under agreement covering the city tramlines, reached the sum of \$67,861.38, as compared with \$48,549.41 for 1910. The proportion for December, 1910, was \$6,509.03, as compared with \$7,870.94. For December 1911 the number of passengers carried was 3,706,649, in December 1910 the number was 2,927,300.

D. R. Kennedy, Superintendent of Construction for the B. C. Electric Railway Co., at Vancouver, has been promoted to the position of superintendent of power and lines, in succession to W. T. Woodroffe, who resigned recently to accept the position of city electrician of Vancouver. Mr. Kennedy entered the company's service in Victoria in 1896, resigning in 1900 to take another position. He returned to the B.C.E.R. in 1908.

The following grants for telegraphs, etc., were included in the main estimates announced in the Dominion House during the early part of the year. Golden-Windermere telephone line, \$800; Kamloops to Walhatchin, telephone lines, \$3,600; Okanagan Valley telephone system, \$4,750; telephone line between Kuper and Thetis islands and Chemainus and Vancouver Island, \$1,000; Vancouver Island telegraphs, \$5,500; telegraph lines generally, \$7,000.

Winnipeg and the Middle West

The Power Rates in Winnipeg

The following rates are now in operation in the city of Winnipeg and probably form the basis of the disagreement between the late power manager, Rossman, and the Commissioners of that city. It will be remembered that Mr. Rossman, on sizing up the situation, fixed a rate at which it would be possible to operate and pay expenses. This rate was approximately 6 cents per kw.h. Later, however, pressure was brought to bear by some of the Winnipeg press and a number of the voters, and the price was reduced to 3 1/3 cents per kw.h., with certain discounts. The published rates for power are now as follows:—The first 50 hrs. use per month of total connected load, 3.33c. per kw.h.; the next 50 hrs. use, 2.5c.; the next 50 hrs., 1.9c.; the next 50 hrs., 1.4c.; the next 50 hrs., 1.1c.; all over 250 hrs. at .8c. In addition to this liberal rate there are wholesale discounts as follows, applicable to gross bills of over \$100 per month:—For the 2nd \$100, 10% discount; for the 3rd \$100, 20% discount; 4th \$100, 30% discount; 5th \$100, 40%; \$500 to \$1,000, 50%; over \$1,000, 60%. A second discount is allowed for prompt payment:—one year contract 10%; three year contract 15%; five year contract 20%.

The starting rate for commercial lighting is 3 1/3c. per kw.h., with the following discounts: for the first \$50 per month consumption, no discount; for the second \$50, 10%; 3rd \$50, 20%; 4th \$50, 30%; 5th \$50, 40%; \$250 to \$500, 50%; excess over \$500, 60 per cent.

Prompt payment discounts on term contracts are allowed the same as on power contracts.

Electrical Operations in Medicine Hat

Owing to the abundance of gas found in the neighborhood of Medicine Hat electrical operations can be carried on at the lowest possible cost and it is doubtful if much better power rates can be given anywhere in Canada. The actual cost of gas production is said to be not over one cent per thousand cubic feet and the electric light department of Medicine Hat only pays the gas department at the rate of 5 cents per thousand cubic feet, with which they operate their Crossley gas engine plant. This explains in part the unusually reasonable rates which this city has to offer to manufacturers and others requiring a plentiful supply of power. Another reason is that they are in the electricity business not for profit but simply to induce manufacturers to locate within their limits. A copy of the monthly power rates follows:—For consumption up to 100 kw.h. 6c.; from 101 to 250 kw.h., 5 1/2c.; from 250 to 450 kw.h., 5c.; from 450 to 650 kw.h., 4 1/2c.; from 650 to 850 kw.h., 4c.; from 850 to 1,050 kw.h., 3 1/2c.; from 1,050 to 2,000 kw.h., 3c.; from 2,000 to 3,000 kw.h. 2 1/2c.; from 3,000 to 5,000 kw.h. 2c.; from 5,000 to 25,000 kw.h., 1 1/2c.; from 25,000 and upwards, 1c. Ten per cent. discount is allowed on all of these accounts where more than a 2c. rate is paid. On the 2c. and 1 1/2c. rate, 5 per cent. is allowed. No discount is given off the 1c. rate. Special rates are given for restricted hour use.

Further Power Increase in Saskatoon

In order to keep abreast of the rapidly increasing power demands, Superintendent A. G. Sangster, of the Saskatoon Municipal Electric Plant has submitted estimates for the expenditure of approximately \$175,000 in additional generating machinery. The installation has just been completed of a 750 kw. C.G.E. generator, which in addition to the old generators, which are also being placed in the new power

house, will bring the capacity up to something over 1,500 kw. It is announced this will be largely increased by the addition of a further 2,000 h.p. equipment. When the water power on the Saskatchewan River is installed this steam plant will become an admirable auxiliary.

Some objection has been raised in Saskatoon to the action of the municipality in selling electrical household appliances at cost, thus killing the trade for private electrical supply firms. It was pointed out that this course had been followed owing to the necessity of building up a day load. It was agreed, however, that the price of globes would be raised 5c each and that a 25 per cent. increase on the sale price of all larger articles should be made.

Calgary Making Large Expenditures

The city of Calgary recently passed a by-law authorizing the expenditure of nearly \$400,000 in equipments and extensions of various kinds. Much of this will be spent on electrical equipment. Tenders have already been called for another 2,500 kw. turbo-generator, a 1,000 kw. synchronous motor-generator for street railway work, a 50 kw. motor-driven exciter and a 25 kw. motor-driven exciter. Tenders will be received for these by the Power Commissioners of Calgary until noon, March 15th.

Electric light expenditures are also prominent in the new extensions. Four hundred additional street lamps will be installed, and transformers for both light and power are required, together with meters, cross arms, poles, hardware, etc. A new sub-station will also be built on Ninth avenue west. A 5,000,000 gallon motor-driven centrifugal water pump will also be required.

Fort Frances Lighting Rates

On January 1st Fort Frances reduced its lighting rates to a schedule which now compares favorably with rates given in the largest cities throughout the Dominion. The regular rate is now 7c. per kw.h. with the following discounts:—up to 50 kw.h. per month 35 per cent.; from 50 to 100 kw.h. per month 40 per cent.; 101 and over kw.h. per month 45 per cent. Window lights and signs may be put on separate meters and current paid for at the rate of 5c. per kw.h. with 50 per cent. discount; the installation of the meter in this case is at the expense of the consumer.

North Battleford Issuing Debentures

The town of North Battleford is floating debentures at the present time amounting in all to \$233,150, to be distributed as follows:—Waterworks extensions, \$55,000; electric light extensions, \$40,000; sewage system extensions, \$87,000; cement sidewalks, \$38,650; street grading, \$6,000; exhibition grounds and buildings, \$6,500. Mr. M. D. Cadwell is superintendent of the water and light department.

The centrifugal pump recently installed at the river some three miles from Portage La Prairie for the purpose of filling up the Crescent Lake bottom is now in operation. The pump is a Gould's centrifugal type, 18-in. suction, 15-in. discharge, capable of delivering 5,000 gals. per minute against an 8-foot head. Power is furnished by belt from a Westinghouse 3-phase, 60-cycle, 220-volt induction motor. Everything is said to be operating very smoothly and it is estimated that the old lake bottom can be filled to the required depth in about 100 days pumping of 24 hrs. each.

Montreal and the Province of Quebec

Inspectors Will Be Active

At the recent conference in Toronto of the bona fide rubber covered wire manufacturers of Canada and the electrical inspectors, when it was agreed that on and after January 1, 1913, only rubber covered wires and cables having insulation in accordance with the National Electrical Code, 1911, specifications would be made and required by Electrical Inspection Departments throughout the Dominion of Canada, the question of Factory Inspection and Label system under the supervision of the Underwriters' Wire Inspection Department was also discussed with Mr. A. R. Small, Superintendent of the Label Service of the Underwriters' Laboratories, Inc., who was present at the Conference.

Mr. J. Bennett, chief inspector for Quebec electrical department of the Canadian Fire Underwriters' Association, Chairman of the Conference, has received communications from some city electricians, one of which expresses the opinion that under this agreement Canada may become the dumping ground for the United States wire manufacturers. Another writes: "I am somewhat surprised that the date of the manufacture of the new code wire has been put off until January 1, 1913; as far as this department is concerned we will not agree to any arrangement that does not provide for a factory inspection and label system under the supervision of the Underwriters' Wire Inspection Department, and we hold ourselves open to make any arrangement in the premises that we see fit unless this inspection service is taken and provided for."

In reply Mr. Bennett wrote: "With reference to the opinion expressed regarding the advisability of an early date being set for the putting into effect of what is undoubtedly an improvement, and the undesirability of Canadian manufacturers lagging behind the American manufacturers in regard to this higher grade of material, I may say that this absolutely agreed with my own views and the views of other inspectors in the East, but we had to achieve in one month what has taken four years in the United States, and that the result could at all be brought about was only possible through the goodwill of the Canadian manufacturers; so we considered them when setting the date. We cannot enforce our requirements in any other way than through insurance premiums, but we realized that if the wire manufacturers would agree not to make any old code wire after a certain time had elapsed between the date set for discontinuance of the old code wire in the United States and the coming into effect of the new code in this country, the Canadian manufacturers will be in a position to offset the dumping, and the inspectors will have to be active in their measures to reject any wire made in the United States after July 1, 1912, that does not bear indications of being new code standard."

Board of Trade Alarmed

At the annual meeting of the Montreal Board of Trade, a resolution was passed expressing alarm at the exploitation of the waters of the St. Lawrence for power purposes, and declaring that Montreal should have the advantage of low electric power rates which are so essential to the growth of a city and to the full development of its manufacturing industries. The Board asked the Dominion Government, before sanctioning the various schemes for the development of hydro-electric power on the St. Lawrence and Ottawa rivers, to request the Conservation Commission to draw up a comprehensive scheme for the preservation of these

waters as great national waterways, and that the Commission should take immediate action to prevent the natural resources of the public domain from passing into the hands of private parties. The government was also requested to instruct the Commission to consider what "means it is advisable to adopt"—first, in regard to the licensing of hydro-electric companies; second, what check it is desirable to put on the increases in the capital of the various companies, in order that some means may be evolved for giving the public electric power at a minimum rate, yet at the same time allowing the various electrical companies to make a reasonable return to their shareholders on the paid-up capital; third, to prevent, if possible, such companies making unwarranted increases in their capital stock on the basis of earnings; and fourth, to consider whether a Hydro-electric Commission should be established by the Dominion Government to govern rates of power companies on a similar basis to the Board of Railway Commissioners, or whether it would serve the public interest better for the government to itself develop hydro-electric power and distribute the same on lines similar to those of the Hydro-electric Commission in Ontario."

The Board of Trade is further of opinion that all power developed in Canadian waters will be required for Canadian use, and that no power should be allowed to be diverted from this country. It is asked that no works shall be allowed which will interfere with the development of the navigation interests.

Quebec Association Elects Officers

Mr. N. Simoneau presided at the annual meeting of the Electrical Association of the Province of Quebec, on February 9, at the Edinburgh Cafe, Montreal, when the officers for the year were elected. In the absence of the secretary, Mr. W. B. Shaw, the treasurer, presented the annual report, which gave a resume of the year's operations, and referred to the success of the weekly dinners. A question, still unsettled, which had occupied a good deal of attention, was, whether contractors should get their wiremen licensed by the city. The association had decided to leave the Builders' Exchange, owing to lack of funds. The balance in hand was \$67.35. It was decided in future to hold the meetings at the Edinburgh Cafe every second Thursday in the month.

The election of officers resulted as follows, there being no contest except for the executive council: President, Mr. Clarence Thomson; vice-president, Mr. L. Rousseau; 1st vice-president, Mr. H. D. Crouch; treasurer, Mr. S. W. Smith; the selection of a secretary was held over for a month. The executive council is as follows: Messrs. J. A. Valois, C. E. McGregor, W. M. Turnley, W. N. Dietrich, E. Jackson, R. Moncel, R. J. Hiller, J. D. Lachapelle. Mr. Thomson, on taking the chair, asked the council to give him the same assistance as that rendered to Mr. Simoneau. Votes of thanks to Mr. Shaw and Mr. Simoneau terminated the proceedings.

Tungsten System for Pointe Claire

The town of Pointe Claire, P.Q., has decided on a system of street and house lighting, and the work is to be carried out by Laurin & Leitch, Montreal, on plans by Mr. V. Dupont, of Montreal. The plan will be on the series tungsten system. Current will be supplied by the Montreal Light, Heat & Power Company from a sub-station, and will be de-

livered at 2,200 volts. In the sub-station will be placed the necessary apparatus for the control of the lighting and primary circuits, consisting of one 15 kw. constant current regulator for the control of 154, 4 ampere, series connected, seventy-five watt tungsten lamps; a switch-board plug panel for controlling the primary and secondary of the lighting circuit and a feeder panel, on which will be mounted two 100 ampere 3-pole automatic overhead release switches. This panel is intended to control one primary feeder circuit; on the same panel is to be mounted a 50 ampere knife switch, with enclosed fuses, to control the secondary of the small transformers used for lighting the power house. The street lighting is to consist of a series of tungsten incandescent lights each of 75 watt capacity at 4 amperes, with standard Edison base. The plant includes two $7\frac{1}{2}$ kw. transformers fifteen 5 kw. and five 2 kw. transformers, with six miles of o.w.p. secondary wiring. The lamps are to be placed 100 feet apart, and the four pin cross arms are to be double braced.

Sherbrooke Railway & Power Extending

The plant of the Sherbrooke Railway & Power Company has recently been overhauled, under the superintendence of R. A. Ross & Company, consulting engineers, Montreal. The Bishop Construction Company did the work on the dam and power house, while the Jenckes Machine Company furnished the wheels; Lombard & Company the governors, and the Canadian General Electric Company the electrical apparatus, including generators and switches. In a report issued for the six months ending December 30, it is stated that the company's net receipts were \$19,655, and after paying the bond interest there was a surplus of \$6,065. The company has acquired the Eastern Townships Electric Company and the Stanstead Electric Company, which now gives the Sherbrooke concern the lighting and power requirements of Stanstead, Rock Island, Beebe, Derby Line, Derby Centre, Stanstead Junction, North Hatley, Capleton, Eustis, Compton, Waterville, Lennoxville, etc. To provide funds for the purchase of and extension of these properties, building, transmission lines, etc., necessitated the issue of \$300,000 additional bonds and \$300,000 of stock, making a total issue of \$1,000,000 of each. The greater portion of these have been sold.

Electric Line Montreal to Granby

The directors of the Montreal Southern Counties Railway Company have decided on a still further extension. The Board have made an arrangement for the electrification and operation of the Montreal and Provinces line railway between St. Lambert and St. Cesaire, and also intend to extend the line from the latter point to Granby, thus giving the shortest route between Montreal and Granby. A contract for car barns, to accommodate 16 to 20 cars, and a power sub-station at St. Lambert has been let to Messrs. Byers & Anglin, Montreal. The car barns will contain four tracks and are to be 205 x 85 and the power station 80 x 60. The foundations will be of concrete and the superstructures of brick and steel. Work is to be started at once, and will be finished in May. The company will spend about a million dollars this year and expect to add 192 miles to its system during 1912. By July it is expected that the company will be able to run cars to Richelieu.

Commissioners Want Fixed Salary

The Montreal Electrical Commissioners—Prof. Herdt and Messrs. Kelsch and Beaudry Leman—appointed to prepare plans for conduits for laying wires, have applied to the Board of Control, for a fixed annual salary in lieu of a fee for each meeting. They suggest that a remuneration of

\$2,000 per annum would not be excessive, it being claimed that the present rate is inadequate, having regard to the fact that there is a great deal of work to be done apart from the regular meetings. On an average two meetings are held every week, the present work being concentrated on St. Catherine street, between Atwater and Papineau avenues, with the idea of first dealing with the chief business and shopping thoroughfares of the city. Some difficulty has been found in obtaining the requisite information from certain companies, who state they are unable to determine as yet what space they will require in the conduits. It is estimated by Mr. Paul LaRocque, secretary to the Commission, that their work will continue from four or five years, by which time it is hoped the network of wires and poles will have disappeared. The salaries are payable by the city.

Preliminary Plant for National Hydro-Electric

Considerable progress has been made with the work on the preliminary hydro-electric plant being constructed for the National Hydro-Electric Company, Limited, by the Carillon Construction and Development Company, Limited, Montreal, at Carillon Falls. The idea in building this small plant is to obtain power for carrying out a much more extensive scheme and to supply a certain amount of energy. The cofferdams have been completed, and work is now being carried out on the foundations of the power house. Tenders have also been invited for the electrical installation for the preliminary plant, the total cost of the work being estimated at \$150,000. Already applications have been received for power from industrial concerns in Rigaud, Grenville, and Hawkesbury. The company hopes to be in a position by August 1st to furnish power for the work of tunnelling, etc., for the larger scheme, which, when completed, will enable a very large amount of power to be transmitted to Montreal. One feature of the plans is the construction of a bridge at Carillon across the Ottawa River. Mr. A.G. Watts is the engineer in charge of the work.

Tenders Soon Called for Cedar Rapids

The plans and specifications of the Cedar Rapids power scheme are about completed, and tenders will soon be called for the dyke and the power house. The capital of the Cedar Rapids Manufacturing and Power Company has been definitely placed at \$10,000,000, although not more than fifty per cent. will be issued at the present time. There will be an immediate bond issue of \$5,000,000. The building of the plant will take about two years. There will be constructed, parallel to the shore, a dyke some 6,000 feet in length, and when the shore line is excavated very considerably the width of the head race will be about 600 feet, the length of the power house being about the same. The dyke will be composed of clay, cement puddle, etc., and the foundations are to be put in with the aid of a series of cofferdams. Within a few years the company expects to be generating the maximum of power, viz., 100,000 horse power, commencing with a production of 50,000, which will be disposed of to minor concerns in a wholesale manner rather than to individual customers. It is understood that a thousand men will be at work on the plant during the summer. The work is in charge of Mr. Henry Holgate, C.E.

Montreal Companies Merged

The Montreal Tramways and Power Company, Limited, is the name of the holding company under which the Montreal Tramways Company and the Canadian Light and Power Company have been amalgamated. Although there had been several rumors that a holding company was to be formed, it was not until the stock was dealt in that the general public became aware of the actual existence of the concern. As

a matter of fact the company was registered in England more than a year ago. The Tramways and the Canadian Light and Power companies are both under the same control, but it is understood that they will be worked separately. Those shareholders who decline to come into the holding concern will apparently receive their dividends in the ordinary way, while those who decide to join the merger will obtain their dividends from the money paid into the holding company, the directors of which may declare whatever rate they think fit.

Lectured to McGill Undergraduates

Mr. A. L. Mudge, chief electrical engineer of Messrs. Smith, Kerry & Chace, on Wednesday, February 14, read a paper at a meeting of the McGill Undergraduate Society of Applied Science, Montreal, describing the plant of the British-American Power Development Company in the Cobalt district. This interesting paper of Mr. Mudge (who is a graduate of McGill) was illustrated by a large number of slides. The power house is near Lake Temiskaming, and supplies power principally to Cobalt and the mines; there is also a telephone system. Details were given of the construction of the power house, the transmission lines, electrical plant, etc., it being stated that all the engineering was done by university men. Lantern slides of the development at Lac du Bonnet, Man., were also shown.

Farnham Plant Completed

The Corporation of Farnham, P.Q., has just taken possession of the plant constructed for lighting purposes. It has a capacity of 1,000 horse power, and was erected under the supervision of R. A. Ross & Company, consulting engineers, Montreal. The Bishop Construction Company built the power house and dam, the Canadian Boving Company supplied the hydraulic equipment, the Lancashire Dynamo and Motor Company, the dynamos, the Northern Electric and Manufacturing Company, the switches, and the Canadian Foundry Company, the pumps, which are of the Mather & Platt pattern. There is a supplementary steam plant, the engine of which is of the Belliss-Morcom type, and the boiler Goldie & McCulloch manufacture.

Sherbrooke Now Has Civic Plant

The Rock Forest power plant, constructed for the city of Sherbrooke, P.Q., has been turned over to the civic authorities. The plant has a capacity of 2,000 h.p., which will be used for lighting and power purposes, and the surplus disposed of to private consumers. Messrs. Beatty & Morrow were the general contractors for the work and built the dam and power house; the Jenckes Machine Company, Montreal, supplied the wheels and generators, and the Canadian Westinghouse Company the other electrical machinery. R. A. Ross & Company, Montreal, were the consulting engineers.

Tenders Called for St. Jerome

Tenders have again been called for a complete hydro-electric power system for the town of St. Jerome, P.Q., from plans by Mr. DeGaspé Beaubien, of Montreal. In September, last year, tenders were invited for a plant to be developed on the North River, about 23 miles from the town, the plan including a transmission line, high and low tension systems, and street lighting. The tenders, however, were returned unopened, the municipality having decided that the time was inopportune for raising the \$60,000 required for the work.

Robb Engineering Company Contracts

The installation of four 130 h.p. Robb-Mumford boilers has just been completed in the Loughheed Building, Calgary, Alberta. These boilers form part of the largest heating plant in any one building in Western Canada and have been built and installed by the Robb Engineering Company, Limited, who also furnished the steel casing, etc.

The Robb Engineering Company have recently sold a 40 h.p. sawmill outfit to Hugh & Ronald McDonald, Big Marsh, N. S., and a 35 h.p. sawmill outfit to J. W. & Frank McKenzie, Upper North River, N. S.

Miscellaneous

Mr. R. E. H. Jones, of the Imperial Wire & Cable Company, Montreal, is on a visit to Quebec.

Mr. R. A. Ross, of R. A. Ross & Company, Montreal, has been appointed consulting electrical engineer for the city of Toronto.

Through Mr. R. S. Kelsch, electrical engineer, the Sayer Electrical Co., Montreal, have been awarded the contract for the electrical work of the Windsor Hotel power plant.

The Mountain Park Coal Company, which is located west of Edmonton, Alberta, are to install a 150 h.p. Robb-Armstrong engine, together with boilers, smoke stacks, etc., all this apparatus being furnished by the Robb Engineering Company.

Mr. Charles Brandeis, C.E., Montreal, has been appointed consulting engineer to the Saraguay Electric & Water Company, in place of his previous appointment as chief engineer. The change is due to the increase in Mr. Brandeis' professional practice.

Montreal West has granted the Montreal Tramways Company an exclusive franchise for operating street cars within that municipality for the period of fifty years; this includes the transportation of passengers, freight and mails. The ordinary five cent fare for adults is to be charged.

The St. Paul Electric Light Company, which claims it secured a franchise from the town of Cote St. Paul, now Emard Ward, Montreal, to exclusively supply light, heat and power to that Ward, have served a petition for an injunction restraining the Montreal Light, Heat & Power Company from operating in the Ward.

News has been received in Montreal of the death at Ashville, N. C., of Mr. Richard Boronow, a partner in the Engineering Equipment & Supply Company, electrical contractors, Montreal. Mr. Boronow, who had lived in Montreal for twenty years, was 54 years of age. The business is being carried on by Mr. S. W. Smith.

The death has occurred in Montreal, of Mr. Matthew Neilson, the managing director of the Mexican Light, Heat & Power Company. Mr. Neilson, who was 59 years of age, died after an illness of three months' duration of pleuropneumonia. He was at one time manager of the St. John, N.B., Railway, Gas & Electric Company, and was also connected with the C. P. R. as engineer in various parts of the country. He left a widow and one son.



Profile view of Car Barn, Regina's Municipal Street Railway System

ELECTRIC RAILWAYS

Successful Operation at Regina

In September of last year the Electrical News published a detailed description of the equipment then just placed in operation on the Regina municipal electric railway system. The line has now been in successful operation for about five months and we are able to reproduce the following operating figures with reference to that period. The accompanying sketches also show the layout and external design of the modern car barn built in connection with this plant.

The total gross earnings for the five months ending 31st December, 1911, amounted to \$23,637; operating expenses were \$17,646, leaving net earnings \$5,990. This was for an actual operation of 135 days. The gross earnings per car mile amounted to 27.2c. The net per car mile 6.9c., the cost of power per car mile 3.33c., the total number of passengers carried 480,695.

The gross earnings were made up as follows:—Cash fares \$14,467, ticket sales \$8,328, advertising on cars \$641. The operating expenditures for the five months were:—Maintenance of way and structure (including tracks, labor and material, heating and lighting) \$2,023; maintenance of rolling stock \$1,161; maintenance of electric equipment, \$656; conducting transportation (made up chiefly of salaries of traffic inspector, conductors and motormen) \$9,254; power, \$2,898; general expense (including salaries of officers and clerks, stationery, printing, etc.), \$1,654; total \$17,643.

The capital cost of the road up to the present time is \$575,000, which includes 10½ miles of track, the necessary rolling stock and a steam generating plant. 600 volts d.c. is the system used. The number of cars in operation is six, with a similar number being added immediately. Three routes are operated and a 15-minute service given on each.

The tickets are sold at the regular rate of 6 for 25c.

or in book form, 25 for \$1.00; early morning tickets 6 to 7.30 and evening tickets 5 to 7, 8 for 25c.; school tickets, 6 a.m. to 12 p.m., 10 for 25c.; city employees' tickets, a book of 50 for \$1.50.

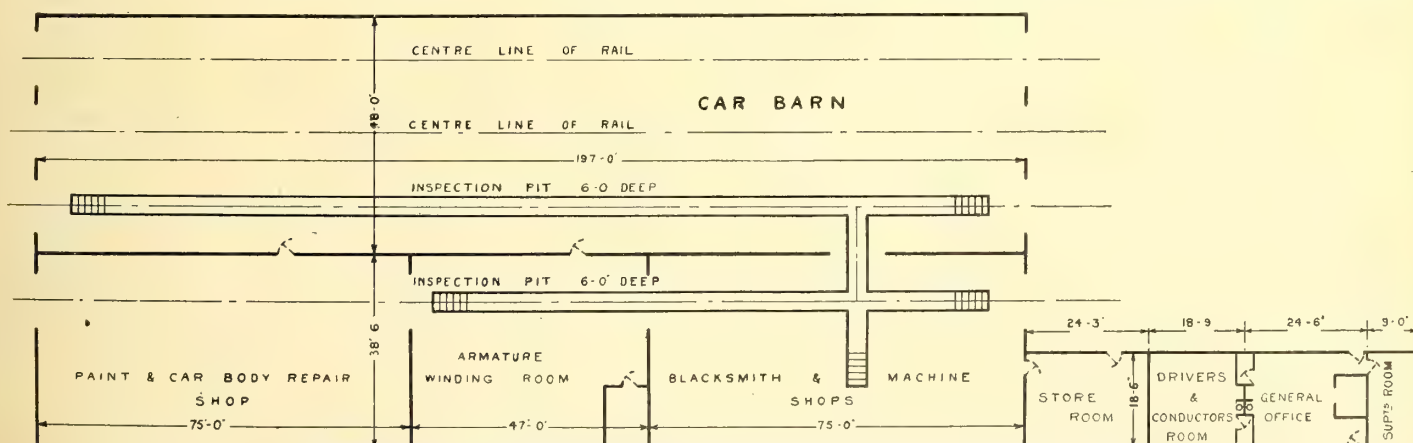
The above information is valuable in view of the number of street railway systems under consideration in cities of about Regina's size, at the present time, in Canada, and goes to show that with careful operation a decided success can be made of the system from the start. Mr. H. Doughty is superintendent of the Regina street railway system.

The London Street Railway

The annual report of the London Street Railway Company, of London, Ontario, for the year ending December 31st, 1911, has just been issued. From the shareholders' viewpoint the report is a very satisfactory one, in that the earnings for the past year have been considerably larger than in any previous year. The list of betterments, replacements and additions also show that consideration for the travelling public has been a prominent factor in the year's operations.

Gross earnings for 1911 were \$279,606, as compared with \$256,278 the previous year. Net earnings amounted to \$86,870, as compared with \$74,086, that is, at the rate of 10.51 per cent. in 1911, as compared with 8.21 per cent. in 1910. The total number of passengers carried was 8,761,005, as compared with 7,994,133 the previous year. The gross earnings per car mile are also a record in the company's history, reaching 19.1 cents. The net earnings per car mile are also high, reaching 6.03 cents.

The company operates 33.25 miles of single track, covering about 26 miles of territory, of which 20.8 miles is in the city and 5.2 miles outside the city limits. The rolling



Ground plan of Car Barn, Regina's Municipal Street Railway System

motor cars, 4 trailers, 2 sweepers, and 3 work cars. The power house capacity is in the neighborhood of 1,150 h.p., which is supplemented by a storage battery plant of 320 amp. hrs. capacity. The buildings of the company include two car houses, one car and machinery shop and one office building.

All the old directors and officers of the company were re-elected. These include: President, H. A. Everett, Cleveland; vice-president, T. H. Smallman, London; and the directors, P. W. D. Broderick, H. S. Holt, E. W. Moore, W. M. Spencer and C. H. Ivey. Mr. John W. Williams is now secretary-treasurer of the company. Mr. Chas. B. King is general manager.

For some months negotiations have been proceeding between the Street Railway Company and the Hydro-electric Power Commission, looking to the purchase of power from the Commission for the operation of the street railway system. Throughout these negotiations the peak load adjustment was the greatest difficulty to be overcome and it has now finally been decided by the directors that they will not purchase from the Hydro-electric Commission. Following this decision a new steam generating unit of a capacity of 500 h.p. will be installed at once.

Tramway for Crow's Nest Pass

During the present session of the provincial house of British Columbia it is expected an application will be made for a special charter incorporating a company which plans to electrify the Crow's Nest Pass district and give its residents the benefit of cheap transportation by means of a modern tramway system. The proposed new railway is projected to traverse the Pass from Cowley, on the eastern side, to Crow's Nest Lake on the west, connecting Cowley and Lundbreck, then running northerly across the C. P. R. track and west to Burmiss, Passburg, Maple Leaf and Bellvue; also connecting Hillcrest, Frank, Blairmore, Coleman and Carbondale; then running south, crossing the C. P. R. and extending west to the lakes, a total mileage of twenty-five. W. A. Beebe, acting for the promoters, states they possess sufficient capital to carry through the undertaking and adds that, in the event of the government approving the proposals to be laid before it, the work of construction can be initiated this spring. The estimated cost of completing the system is \$250,000. It is proposed an hourly car service will be given, and that the location of the power house and head offices of the company be at Blairmore, Alta.

Medicine Hat's Railway Proposition

A company represented by Messrs. Warren Overpack, A. F. Krapfel and D. Brown, is seeking incorporation for the purpose of constructing an electric railway line from the city of Medicine Hat to Elk Water Lake, via Coleridge and Josephburg. The proposed electric line covers the city streets to a certain extent, the terminal point being at the market place. A clause in the proposed agreement provides that at any time, upon six months' notice, the city may acquire that portion of the line constructed within the corporation limits at a valuation to be determined by the cost of construction and maintenance.

The proposition is looked on by the citizens of Medicine Hat as certain to bring them in touch much more closely with the fine farming district surrounding their city, and it is believed the franchise agreement will be ratified.

The Alberta Interurban Railway

Subscriptions were asked early in February for a part of the stock of the Alberta Interurban Railway Co., which

it is proposed to build and operate in the Calgary neighborhood. The projected line radiates from Calgary in almost all directions: to the north-east through Rockview, Irricana, Carbon and on to the Red River; west through Elbow, Morley to Banff; east to Windermere, Strathmore, Bassano and Brooks; south and east to MacLeod, Pincher Creek, Lethbridge, Taber, Medicine Hat, etc. One branch will run from Lethbridge south across the boundary line.

The proposition is to use a light type of interurban car manufactured by the McKeen Motor Car Company and operated by gas engine in much the same way as gasoline operated automobiles are equipped. The McKeen car has the engine resting on the truck below the car body, the object being to remove as far as possible vibration from the coach.

Bassano Electric Traction Company

We understand that it has not been definitely decided yet what type of cars will be used on the Bassano line, the choice lying between the McKeen motor car which is operated by a gasoline engine direct-connected to the drive wheel of the car trucks; a gasoline electric coach of an English type and the regular electric cars. It appears probable that the gasoline car will be chosen. This will likely be a 70-foot long, all-steel construction car operated by a 200 h.p., 6 cylinder, air-starting and reversible gasoline engine. The engine would be located on the front truck entirely independent of the car body, thereby relieving the car of the engine vibration. The drive is direct from the engine to the main axle, which, it is claimed, gives the most efficient drive possible. This type of car is manufactured in Omaha, Neb., U.S.A.

Asks Brandon for Franchise

Mr. B. C. Donham has submitted an application for an electric railway franchise in the city of Brandon, Manitoba. The franchise asked is to run for thirty years, renewable after that date at the end of each succeeding ten year period; failing this, the company to sell out on an arbitration basis of the actual value of the plant exclusive of franchise and good-will. The applicant promises to commence construction work within three months after the passing of the by-law and to have not less than five miles of road in operation in six months from that date, the road to be extended further during 1913 to a total of at least seven miles.

Calgary Extending to C. P. R. Shops

Surveyors are now at work preparing the route for the Calgary street railway's extension to the C. P. R.'s shops site east of the Bow River, and work will be started shortly. It is the desire of the city authorities and of the Canadian Pacific Railway that this work should be completed and the line in operation just as soon as the work on the new shops is under full swing.

British Road Electrifying Suburban Lines

The consulting engineers of the London, Brighton & South Coast Railway are preparing plans for the further electrification of the company's suburban lines and the extension of electric operation to the main line. When the main line has been electrified trains will run from London to Brighton, a distance of 52 miles, in 45 minutes.

Railway Commissioners Have No Jurisdiction

Recently the question of the jurisdiction of the Board of Railway Commissioners for Canada over the matter of freight traffic as carried on between the Montreal Street Railway Co., and the Montreal Park & Island Railway Co.,

was submitted to the Supreme Court of Canada for judgment. Decision was in favor of the company's contention that this Board had no jurisdiction owing to the fact that the Montreal Street Railway operated under Provincial Charter. The matter was later carried to the Privy Council which has just upheld the finding of the Supreme Court.

- Decision Favors Winnipeg Electric Railway Co.

Judgment has been handed down by the Privy Council favoring the Winnipeg Electric Railway Company in every one of its contentions against the city of Winnipeg. It is probable this will pave the way for large expenditures and extensions on the part of the company. Incidentally the decision will circumscribe the operations of the city and make it more difficult than ever to place the municipal system on a paying basis.

Current Railway Notes

The January receipts of the Calgary Street Railway were \$37,439, or nearly double those of a year ago.

The Quebec Railway, Light & Power Company will extend its tramcar lines so as to connect with the new Grand Trunk Pacific shops.

The Niagara Fruit Growers' Tramway has made application for incorporation to operate an electric line connecting Niagara Falls, St. Catharines, Port Dalhousie and Queenston.

One of the directors of the Stratford Street Railway Company is quoted as saying that construction on the Stratford Street Railway system will be under way not later than May 1st of this year.

Application has been made for an Act incorporating the Lindsay and Minden Railway Company, with power to construct and operate an electric railway connecting the town of Lindsay with neighboring towns.

The Galt, Preston and Hespeler Street Railway Company has been granted a ten-year renewal of franchise dating from February 2nd, 1911. The Street Railway Company pays the town of Galt the annual sum of \$640.

Application will be made to the Legislative Assembly of the Province of Manitoba for an Act incorporating "the Wheat City Electric Railway Company" to construct and operate an electric railway in the city of Brandon and vicinity.

The gross income of the Toronto Street Railway Company's system has increased in ten years from \$1,661,017 to \$4,851,541, which were the earnings for the past year. Net earnings have increased in the same time from \$803,405 to \$2,198,179. The number of passengers carried has increased from 38,848,087 to 120,997,844.

Winnipeg Electric Railway Company will increase their capital from \$6,000,000 to \$10,000,000. It is said \$3,000,000 of the new stock will be issued immediately at par to the present shareholders. A large list of extensions and improvements are planned for the present year. The gross earnings for 1911 amounted to \$3,829,749; net earnings \$1,928,782.

Although the deficit of the St. Thomas Municipal Railway system has not yet been wiped out, it has been reduced by the considerable sum of \$2,400 as compared with the year

1910. It is understood that continued effort will be made to gradually wipe out the remainder of the deficit and that to this end needed extensions will be carried on during the present year.

The Sherbrooke Railway & Power Company has completed its transmission line from Sherbrooke to Stanstead, a distance of about 32 miles and as the sub-station at Stanstead is practically completed it is expected the line will operate at once. It is understood that the company has arranged a number of additional power contracts, announcement of which will be made in the near future.

An application has been made by the Toronto Suburban Railway Company to the legislature of the Province of Ontario for an act authorizing the company to extend its line from some point at or near Guelph to some point at or near Berlin, Preston, Hespeler and Galt and thence to Hamilton, passing through the townships of Guelph, Waterloo, Dumfries, Puslinch, Beverley, Flamboro West and Ancaster.

The Ottawa Street Railway annual figures, recently published, show gross earnings of \$840,680 for the past year, an increase over 1910 of \$91,971. Of these net earnings are \$354,691, which after payment of all charges amounts to 23 per cent. on the paid up capital stock. This company still holds the Canadian record for high capital earnings and seems each year to be placing itself farther out of the reach of competition.

The double-tracking of the B. C. E. R. Company's interurban main line between New Westminster and Vancouver will be completed in the early spring. The cut-off on the line in Burnaby municipality will also be built as soon as possible, giving a maximum grade of 3.7 per cent. instead of the 10 per cent. grade on Twelfth street hill entering New Westminster. With these improvements completed the running time between the two cities will be greatly shortened.

Trade Inquiries.

144. **Electrical fixtures.**—A London firm of universal electrical providers and manufacturers who manufacture all classes of electrical fixtures, especially for the Canadian market, are desirous of getting into touch with actual importers in the Dominion.

148. **Agents.**—A Lancashire firm desires to find a market in Canada for static transformers; also electric lifting tackle such as hoist blocks, runways, light cranes, crabs, winches, &c.; and are prepared to appoint reliable agents in each province and each important business centre.

March Meeting Toronto Section A.I.E.E.

The next meeting of the Toronto Section of the American Institute Electrical Engineers will be held on Friday evening, March 1st, at 8 p.m. in the rooms of the Engineers' Club, Toronto, 96 King street west. Mr. Julian C. Smith, Chief Engineer of the Shawinigan Water & Power Company, will read a paper illustrated by lantern slides on the Shawinigan Water & Power Company's new power house and 110,000 volt transmission line to Montreal.

On Friday evening, April 5th, Mr. Wills MacLachlan, Belleville Manager of The Trenton Electric & Water Company, will read a paper illustrated by lantern slides on the "Electrical Equipment of the Port Colborne Elevator."

CANADIAN TELEPHONES

New Bell Exchange in Ottawa

The Bell Telephone Company have practically completed a second office building on Besserer street at the corner of King Edward avenue, Ottawa, and have commenced installing the telephone equipment, which will be ready for business in May next. The growth of the district in which the present Queen street Exchange is situated is such that the capacity of that exchange will be required to take care of it, while the expansion of the eastern section has also been so rapid as to justify and shortly necessitate the new office. The opening of this branch office means that Ottawa is the third city in Eastern Canada to require this extension of facilities.

The building is 116 feet long by 40 feet wide, two storeys high and basement, and is designed to carry another storey in the future. The construction throughout is the best fire resisting type. The exterior walls are finished with red pressed brick and Ohio sandstone trimmings. The design is of a simple dignified character, with a large window area, giving the building a maximum of light and air.

The main entrance is in the centre of the Besserer street facade, the vestibule of which leads into a commodious public space, from which is entered, on one side, the operators' quarters, which occupy the west half of the ground floor fronting on King Edward avenue. These quarters contain a large locker room (in which are placed the operators' clothes, lockers and drying closet), lunch room, kitchen, rest and retiring rooms, and sick room. In the basement beneath the locker room, reached by a private staircase, are the operators' toilet and bath rooms. The eastern half of the ground floor is entirely devoted to the housing of the power and terminal apparatus associated with common battery switchboards of the type being installed. The entire top floor is used as an operating room and contains the subscribers' and incoming trunk switchboards. It is particularly well lighted and well ventilated.

The whole of the central portion of the floor of the operating room, that is, between the switchboards, is raised 13½ inches higher than that portion of the floor on which the switchboards stand. This construction permits of the operators sitting on chairs of normal height, and, at the same time, more readily permits of their making any connection to the most distant parts of the switchboard which they are obliged to reach. At the same time, access to all parts of the back of the switchboard is exactly the same as in buildings of earlier construction, where the entire floor of the operating room is on one level.

Latest Standard Battery Relay Type

A good fire escape on the rear elevation is provided, reached by doors swinging outward from the operating room and from the operators' quarters, to the yard beneath.

In the basement, which, on account of the slope of King Edward avenue, is really a ground floor in relation to the yard level, are situated furnace and coal rooms, men's lavatories, battery room, cable terminal entrance room, and across the King Edward avenue front is a large, bright, cheery employees' assembly room.

The equipment will be of the latest standard battery relay type, the same as that now being installed at the new "LaSalle" office, Montreal, and to be installed in proposed new offices in Toronto. The lines will enter the building underground in lead covered, paper insulated cables which will be connected to the main frame by silk and cotton covered insulated cables. The main, intermediate and

relay frames, the coil racks for the lines and in-trunk switchboards with their fuse panels, the power plant and two-position inspectors' desk will all be located in the terminal room at the east end of the ground floor.

The power plant will consist of the main battery of 11-G chloride cells and a smaller set of 11-E-11 cells, the latter battery being used to reinforce the main battery for long distance work. Two machines will be provided for charging the larger battery, one being held in reserve in case of a break down. Each will consist of a Western Electric Company's generator of 18 kw. capacity at 30 volts. The generators are of a standard telephone design specially built for charging telephone batteries, having a large number of commutator segments and specially shaped pole pieces, the idea being to eliminate noise from the associated telephone service when the battery is being charged. The smaller battery is charged by a smaller generator which has an output of 600 watts.

Two machines will also be provided for furnishing alternating current for ringing subscribers' bells and with special interrupters arranged to give automatic intermittent ringing of subscribers' bells on calls originating from the other office. These interrupters will also give an interrupted direct current to work the many signalling circuits required for an equipment of this type. The necessary switches, circuit breakers, measuring instruments, etc., will be mounted on a black slate switchboard. From this terminal room the lines will be run to the switchboards on the floor above in switchboard cables supported on structural steel runways.

Switchboards for 10,400 Lines

Two separate switchboards will be provided, one to care for the subscribers' lines directly connected to this office and the other one, the in-trunk switchboard, to complete connections that originate from the other office. Both switchboards will have a capacity of 10,400 lines and will be equipped for 3,200 lines. This equipment will represent the latest type of circuits. Those of the in-trunk switchboard will include the keyless incoming trunk circuits similar to those being supplied to Montreal and Toronto. The in-trunk switchboard will also have another new feature in the use of what is called an intermediate distributing frame for the in-trunk lines. This is a special rack, with provision for all the cord circuits of all the various in-trunk operators' circuits ending on one side and all the in-trunk apparatus ending on the other. By means of jumpers a position may be connected with its full capacity of cord circuits with trunk lines and other positions may be connected with the number of in-trunk lines that the operator occupying it is able to handle. In this way the minimum amount of in-trunk apparatus is left idle and the best efficiency of the positions is assured.

All the structural steel telephone apparatus in the terminal room will be coated with aluminum paint (not the usual grey iron color) and will give the room a bright and cheerful appearance.

The opening of this office necessitates a considerable amount of new equipment being installed in the present office on Queen street. This will include a new in-trunk switchboard, similar to the one being supplied for the new office, from which connections will be completed on calls originating from the new office. At the present time, there being only one office in this exchange, no prefix is given to the operator when asking for a number. After the equipment in the new office is placed in service, it will be necessary

to prefix all calls for the Queen street office by the word "Queen" and all calls for the new office by the word "Rideau," these two words being the ones decided upon as most suitable for designation.

C. P. R. Line Extensions

The president of the C. P. R. has authorized further appropriations for despatching trains by telephone, bringing up the mileage by 700 miles. The new routes are as follows: Kamloops to North Bend, B. C., 121 miles; North Bend to Vancouver, B. C., 129 miles; Medicine Hat to Lethbridge, Alta., 116 miles; Moose Jaw to North Portal, Sask., 167 miles; Guelph Junction, Goderich and Listowel branch, Ontario, 112 miles; Grand Mere and St. Gabriel branch, Quebec, 58 miles. The company has also arranged for telephone despatching circuits, so that they are now able to obtain a through telegraph circuit over the telephone despatching wires in addition to and without interfering with the telephone despatching. The circuits so far equipped are:—Montreal to Richford, Vermont, and Montreal to Quebec; those being now equipped are Toronto to Sudbury and Toronto to Ottawa.

Authority has been given by the president of the C. P. R. for the erection of additional copper wires as follows: Can-so, N. S., to Montreal, Que.; Montreal, Que., to Winnipeg, Man.; Winnipeg to Moose Jaw, Sask.; Saskatoon, Sask. to Calgary, Alta., via Edmonton; besides several short circuits, making a total of about six thousand miles of new wire. In addition to this extensive work, authority has been given for the reconstruction of a considerable portion of the line in various parts, in order that the telegraph system may be kept up to its present high standard. There will also be telegraph lines built along new branches of the railway to be constructed during the coming season.

It has been decided to instal on the 90.25 miles of the St. John to Vanceboro section of the C. P. R.: the Hall Signal automatic block signals at a very large cost. This will be the first extensive automatic installation of block signals in Canada, and out of a total of 192 miles of track, including 33 miles of double track on which the C. P. R. is installing these signals, nearly one-half of the trackage to be so equipped is in New Brunswick, the other sections being as follows: Romford Junction to Sudbury, 3.2 miles single track and 3.8 miles double track; West Toronto to Bolton, 21.6 miles single track; Place Viger to St. Therese, 20 miles double track; Montreal Junction to Brigham Junction, 34.5 miles single track and 9.5 miles double track; Islington to Streetsville, 12.9 miles single track. Style "K" top post signals, with the arms working in the upper quadrant and three positions, will be used. The work of installation will be begun in the spring after the frost is out of the ground. On the Canadian Pacific the night signal colors are green for proceed, yellow for caution, and red for stop. The signals will be arranged to stand "normal danger," and the apparatus and construction will conform to the specifications of the Railway Signal Association.

Growth of B. C. Telephone Co.

On January 1, 1910, there were 8,131 telephones in the Vancouver exchange; on January 1, 1911, there were 10,918; and on January 1, 1912, there were 16,129, an increase of 47 7-10ths per cent. in the last year, and an increase of 98 3-10ths per cent. in the last two years. This growth has demanded the expenditure of large sums of money in a short period of time, and represents strenuous work on the part of all concerned. The past year has seen the opening of two branch offices, and these, in addition to the Highland office to be built at once, will furnish facilities for a still greater growth in 1912.

Special service has been in great demand, much of the development being in the way of private branch exchanges

and inter-communicating sets. The following statement shows just what has been done along these lines:—10 hotel P. B. X. systems, with 1,219 stations; 34 commercial P. B. X. systems, with 358 stations; 56 inter-communicating systems with 285 stations; 8 apartment house systems, with 302 stations. Total, 108 systems, with 2,164 stations.

Bell Company Co-operating

During last November the Board of Trade of Toronto issued forms to its members asking data in connection with individual telephone services. It is understood that the information gained was not sufficiently conclusive on which to base improvements in the system and further records are being asked during the month of February. It is understood further that the Bell Telephone Company is co-operating very heartily with the Board of Trade in this matter and express themselves as very willing to do everything in their power to improve the service. This plan of improving a public utility service commends itself as being infinitely superior to an agitation through the daily press or the holding of public indignation meetings to inflame the passions of the electors. Common sense would have suggested that some such method be used in connection with other public utilities operating not only in Toronto but in many other cities and towns throughout the Dominion.

New Exchange in South Vancouver

The British Columbia Telephone Company recently submitted a programme to the South Vancouver Board of Trade, detailing the conditions under which the company is prepared to handle business in the municipality. The company claims that by means of the suburban exchange, which is located a little to the south of the Municipal Hall, a cheap toll rate of 5c will be made for switching to and from Vancouver city telephone exchange, the service being handled by the rapid two-number method. All telephone numbers within the South Vancouver exchange will be transferred from the Vancouver exchange, and it is expected the transfer will be made about March 1st, the new exchange being styled "Fraser," with all attached numbers having that prefix.

Measured Service in Vancouver

The British Columbia Telephone Co., Ltd., Vancouver, are about to put into practice the plan of measured service, making its adoption by the subscribers optional. Under the new plan the subscription for a business phone will still be \$4.00 per month, the company agreeing to furnish all incoming calls free, but reserving the number of out-going calls to one hundred. A charge of 2c is made for each outgoing call over and above the one hundred allowed. In future the company will give the subscriber the choice of measured rate quoted above, or unlimited service at \$5.00 per month—an increase of \$1.00 per month on old subscription rates.

Party Lines for Toronto Island

The Bell Telephone Company quoted the following rates for telephones on Toronto Island: business telephones \$50 per season; residence telephones \$30 per season; these rates to hold if 100 people sign contracts. An alternative offer is for a business phone on a two-party line costing \$50 and a residence phone on a four-party line at \$25. It is understood that the first proposition means a day service only while the party line would supply a 24-hour service.

Ottawa Agreement Terminates June 14

The agreement between the city of Ottawa and the Bell Telephone Company terminates on June 4th of the present year. At the present time house phones in Ottawa cost \$25

a year and business phones \$15 per year and for the privilege of doing business the Bell Telephone Company pays the city the annual amount of \$5,000 in addition to which the city receives twenty civic telephones free. It is hoped by the council at Ottawa that a more favorable arrangement can be made with the Bell Telephone Company when the franchise expires, failing which it is likely the city will consider the question of establishing a municipal telephone system.

Miscellaneous Topics

The Ivy-Thornton Telephone Company have obtained a charter.

The Mississippi Telephone Company, Limited, with head office in Lanark, has been granted a charter.

The Provincial Government has announced that they will construct a new central telephone exchange at Weyburn, Sask., with a switchboard accommodation for 1,000 subscribers.

Announcement has been made by the Provincial Government of Saskatchewan that a new central Telephone Exchange will be established at Weyburn with switchboard accommodation for one thousand instruments.

There are at present six thousand telephones in the city of Calgary, as shown by the new directory issued recently. This number is increasing as fast as installations can be made, there being some 350 requests on order at that date.

The Kootenay Telegraph Lines, Ltd., have completed arrangements with the Western Union Telegraph Company, whereby, commencing Feb. 1st, they will place the citizens of Cranbrook, B.C., in direct communication with the entire world.

H. H. Millie, of Kelowna, B. C., recently disposed of his urban and rural telephone system to the Okanagan Telephone Company, which is now in possession. The consideration is understood to be in the neighborhood of \$55,000.

At a meeting of Dover Township farmers held recently an executive committee was appointed and estimates will be prepared of the cost of installing a rural system. A signed list, containing over fifty names of those ready to subscribe, was obtained.

It is said that long distance telephone communication has been established between London, England, and Amsterdam and Rotterdam, and that in the near future the government hopes to be in a position to install a similar service with some point in Switzerland.

A recent statement shows that there is now a total of 480,000 h.p. developed in Norway and that work is proceeding with the further development of 430,000 h.p. In addition the public works department have applications for concessions involving a further 200,000 h.p.

The Hon. Richard McBride, Prime Minister of British Columbia, addressing the Farmers' Institute of that province recently, stated that he did not think the time was yet ripe for the government to go into the telephone business. He

stated that while his sympathies were along that line and in favor of the betterment and extension of telephone service throughout the province he considered the question too large a one to be taken up without the most careful consideration.

The Bell Telephone Company of Toronto has issued a circular letter to its subscribers stating that telephone directories will now be issued three times a year, and that the former charge of \$4 per line per annum for each extra listing will be increased to \$5 per line per annum.

A telephone committee has been appointed by the Montreal City Council. Alderman Blumenthal, the chairman, is in favor of a municipal system, regarding the present charges as altogether too high. Under a municipal system he believes that the charges could be greatly reduced.

At the annual meeting of the Colborne Municipal Telephone Company, the report of the Commissioners showed the system to be in a prosperous condition and that the cost of maintaining it for the past year, including salary of switchboard operator, only amounted to \$1.86 per phone.

The Bell Telephone Company has made application to the Dominion Railway Board of Commissioners for the establishment of the standard rates in Montreal of \$55 for a business telephone and \$35 for a house telephone. The city authorities are also applying for a general reduction in rates.

The Bell Telephone Company has reduced the North Toronto telephone service \$5 per phone. The method of distance measurement has also been changed, the distance of any customer from his exchange being considered not along the streets, which may be at right angles, but along the shortest distance between the two points.

The estimated expenditure on the public works of the province of Alberta, as indicated by Premier Sifton's recent statements, will total for the present year something over \$10,000,000. Of this amount no less than \$4,000,000 will be expended in construction and extension work on the government telephone system.

It has been decided to run a trunk telephone line between Addison and North Augusta, connecting the Leeds & Grenville independent telephone system with another system operating in Addison, Rockspring and Greenbush. The distance is about 10 miles and the action indicates the direction which independent telephone development is likely to take in the near future.

Premier Sifton has promised an immediate extension of the telephone system in Calgary. Some time ago it was intimated that equipment for 3,000 additional services would be installed at once and part of this equipment is understood to be already in hand. It is stated that there are 500 applicants in the city of Calgary who are unable to get service. In Calgary the automatic system of central is in use.

Recently the Penticton, B.C., local telephone system was absorbed by the Okanagan Telephone Company, with the result, just announced, that the rate of business phones will be raised. This rate will in future be \$4 a month. There is much protest against this rate as it is held by the citizens of Penticton that a condition in the franchise agreement provides that rates cannot be raised above the present \$3 rate.

Questions and Answers

GENERAL RULES TO BE OBSERVED BY CORRESPONDENTS

1. All enquiries will be answered in the order received, unless special circumstances warrant other action.
2. Questions to be answered in any specified issue, should be in our hands by the close of the month preceding publication.
3. Questions should be confined to subjects of general interest. Those pertaining to the relative value of different makes of apparatus, or which for intelligent treatment, should be placed in the hands of a consulting engineer, cannot be considered in this department.
4. To avoid trouble and unnecessary delay, correspondents should state their questions clearly, so that there can be no possible doubt as to the information required.
5. In all cases the names of our correspondents will be treated confidentially.

The Mercury Vapor Converter

Q.—Will you explain how a so-called mercury-vapor converter changes alternating into direct current. Would the current so produced be satisfactory for charging storage batteries or could it be used for lighting arc lamps? I have heard that the life of this type of apparatus is not very great. Can you tell me whether this is so or if there is any means of lengthening the life of the converter.

A.—You will best understand the operation of the mercury vapor converter by studying the two figures given herewith. The theory of the lamp is not perfectly understood, but the fact has been established by experiment, and on this the operation of this apparatus depends, that an electric current passes readily through mercury vapor from the positive to the negative electrode, but will not pass from the negative

trode which is attached to the neutral. It will be seen, however, that between the instants when the current ceases to pass from one positive electrode and begins to pass from the other there is no current at all passing through the mercury vapor; under these circumstances there is danger of the circuit being broken; in practice it is found necessary to produce an overlapping in time of these two discharges, by causing one to lag a little; this is accomplished by means of a reactance inserted as shown. The result of this reactance is to delay the decreasing current from one positive electrode until the increasing current from the other is sufficient to maintain the converter in action.

In three-phase transformation shown in Fig. 2, the explanation is entirely similar but the reactance coil is not now necessary, since on account of the three phases, there will be sufficient overlapping to keep the discharge continuously passing.

You will notice that in both the figures there is an extra positive electrode down close to the negative terminal. This is used to start the converter. By tilting the bulb slightly the mercury is brought in contact with the positive electrode near the bottom of the bulb. As the bulb is replaced in its normal position and the mercury drawn away from the positive electrode, an arc is formed in much the same way as in an ordinary arc lamp, thus vaporizing the mercury and making the discharge from the upper electrodes possible. A considerable reactance in this latter circuit prevents the current from discharging ordinarily from this lower positive terminal.

Such a converter is well adapted for charging storage batteries or for electric arc lighting. Indeed it has been used to some extent in d.c. railway operation, but the demands made upon it in this case seemed to have been much too severe and apparently its use in this work has been discontinued.

The life of the converter, which of course is the life of the bulb, varies with conditions depending very much on the method of installation and the treatment it receives from the operator. Much depends on the temperature being kept as low as possible and to this end the bulb is sometimes enclosed in a bath of circulating oil in much the same way as transformers are so immersed. Under such circumstances the life of the converter seems to be prolonged almost indefinitely. Where the bulb has been left exposed and the temperature allowed to get unduly high actual operations show that quite frequent breaks have occurred.

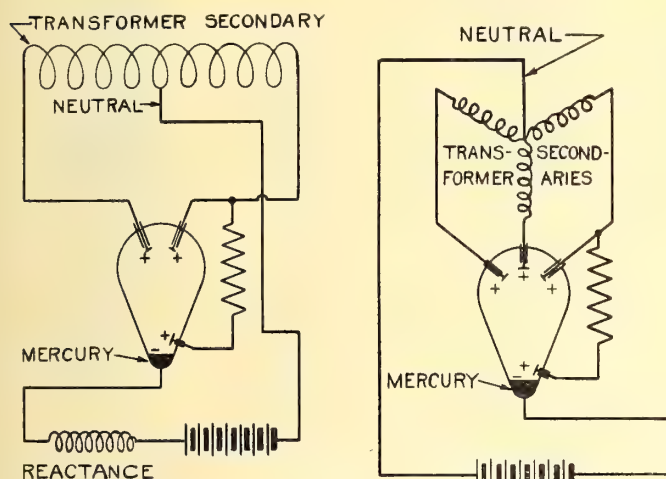


Fig. 1

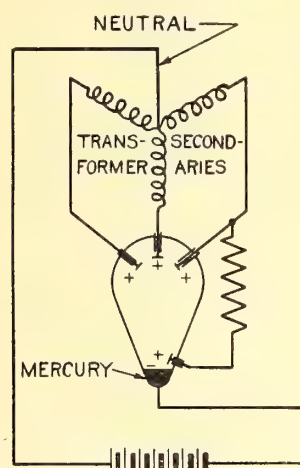


Fig. 2

to the positive electrode. Different theories have been advanced to explain this circumstance, but they are immaterial in explaining the mechanical operation of the lamp.

Fig. 1 shows the construction and connections for a single-phase converter. In the secondary transformer winding here shown, the current is oscillatory, either terminal of the coil being consecutively at a higher potential and a lower potential than the point marked neutral. When either end is at a higher potential than the neutral, the electrode attached to that end of the wire is the one from which the current passes for that instant. When the potential of that electrode becomes lower than the neutral, the discharge no longer passes from that point but is succeeded by a discharge from the terminal attached to the other end of the coil which has now become of a higher potential than the neutral. In this way we have a series of discharges, turn about from the two positive electrodes to the negative elec-

Through Fire and Water

On Saturday, January 20th, 1912, the Marshall Drug Store building fronting on the west side of the public square of Cleveland, was swept by fire which left only the shell of the building. For a number of years the largest and most prominent electric signs in the city have been located on this building. At present the largest of these is the Goodrich Tire sign. This sign, the letters on which are six feet high, contains in the neighborhood of 900 Mazda lamps of the $2\frac{1}{2}$ -watt, 11½-volt sign type. As the weather at the time of the fire was very cold, the large quantity of water which was used to quench the flames froze quickly, causing the building to be coated with ice. The large signs received their share of the water from the fire hose and were also heavily coated with ice. When the current was turned on at night, however, the signs were found to be none the worse for the conflagration, there being only one lamp destroyed. This speaks well for the ruggedness of the lamps as well as the excellence of wiring construction.

W. H. Banfield & Sons, 120 Adelaide street west, Toronto, report large orders received for the spring trade in brass and steel chandelier chains.

Industrial Progress and Trade Notes

Trade Publications

Bakelite—Booklet issued by Plastics, Limited, Toronto, Canada, describing what Bakelite is and what it can be used for.

"Shawmut" Electric Material—Booklet descriptive of fuses, fuse blocks, fittings, etc., issued by Frank G. Schofield, Ontario representative, 702 Lumsden Building, Toronto.

Keystone Truss Pin—Descriptive booklet issued by the Electric Service Supplies Company, giving very full explanatory information on a new type of insulator pin sold under the above name.

Mining Telephones—Publication No. 185, published by the Sterling Telephone Electric Company, Ltd., through their Canadian agents, Chapman & Walker, Toronto, descriptive of bells, signalling keys and electric blasting machines.

Private Telephone Systems—A little booklet issued by the Stromberg-Carlson Telephone Company, illustrating a few of the various types of telephones they manufacture and telling some of the advantages of their private telephone system.

Steam Tables for Condensing Work—A handbook of steam tables with pressures below atmosphere expressed in inches of mercury referred to a 30-in. barometer, published by the Wheeler Condenser & Engineering Company, Carteret, N. J.

Ferro Engines—A practical treatise on correct design and construction of marine engines and equipment, published by the Ferro Machine & Foundry Company, Cleveland. This company claims to be the largest marine engine builders in the world.

Ignition Appliances & Auto Accessories—Section 9, 4th edition, of a supply catalogue issued by the Canadian General Electric Company, Limited, Toronto. The catalogue contains details of every kind of ignition apparatus and automobile requirements.

Condulet Talk—Series 2, No. 6, descriptive of types YC, YS, YD and YX types for 3 to 30 and 31 to 60 ampere cut-outs, plug or enclosed fuses. Issued by Crouse-Hinds Company through their agents the Canadian General Electric Company, Toronto.

The Bristol Company—Bulletin No. 161, issued by The Bristol Company, Waterbury, Conn., describing their line of electrical pyrometers, recording voltmeters, milli-voltmeters, ammeters, water gauges, vacuum gauges, pressure gauges and recording thermometers.

Fables in Telephones—A booklet issued by the Kellogg Switchboard and Supply Company, Chicago, bringing out in the form of fables three features of telephone service, namely, signalling, rates and telephone borrowing.

Illumination Catalogues—Distributed by the R. E. T. Pringle Company:—"Jandus Luxolabra for the City Beautiful," containing handsome illustrated descriptions of a number of designs of lamp standards; "Union Metal Columns," illustrating the design and construction of union metal columns for porches, pergolas and interiors; also bulletin No. 20, descriptive of the Van Dorne & Dutton types D. & A. hard service drill and reamers.

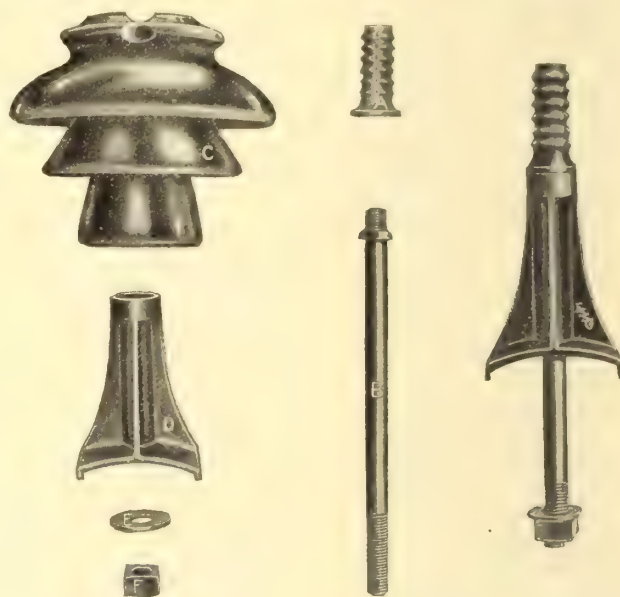
"Conqueror" Pumping Machinery—Catalogue issued by the W. H. Allen Son & Company, Limited, of Bedford, England, descriptive of their pumping machinery, including ordinary centrifugal and turbine type, steam, motor and belt driven. The catalogue is splendidly illustrated, many of the photographs being taken during actual erection and operation of well known British plants. This apparatus has found

special favor in the equipment of large ocean vessels, four of them furnishing the lighting and ventilating equipment in each of the recently launched mammoth vessels, the Olympic and Titanic.

Westinghouse Fan Motors—Circular 1165, just issued by the Westinghouse Electric Manufacturing Company, describing their new line of fans for the ensuing season. The circular illustrates and describes fully each of the different fans, with full data as to shipping weight, current consumption, dimensions, etc. The most interesting feature is the announcement of the drawn steel frame used this year for the first time, resulting in great strength and minimum weight. In addition it furnishes a smooth lustrous surface which is adaptable to a high polish such as is not obtainable with the ordinary cast iron frame.

New Truss Pin for Insulators

There has recently been placed on the market by the Electric Service Supplies Company, a new pin called the Keystone truss pin, which, it is claimed, overcomes every disadvantage of former types of truss pins, with the addition



of many new important advantages. Heretofore it has been necessary to cement the complete pin in the insulator before erecting it. With the Keystone truss pin the thimble only is cemented in the insulator, which assembly is afterward mounted on the truss pin.

The illustrations herewith show clearly the curved base of the Keystone truss pin with the lips that project over the sides of the cross arc. This provides a bearing at the edge of the cross-arm. Therefore, any pull at the top of the pin tends to lift the pin at its centre, throwing a tensile strain on the bolt. With other types of separate top pin which do not have the patented feature of the curved base, the strain that comes on the stud bolt is a bending strain resulting in a deflection back and forth each time that the strain comes on the wire in a different direction. As this bending back and forth continues it results in weakening the bolt, digging a hole in the cross-arm, which permits water to enter and results in rotting and the final loosening of the bolt in the arm. Too much importance cannot be given the advantages of the curved base, which conforms to the shape of the cross-arm, when combined with the sep-

arable thimble. This assemblage gives all of the advantages of any separable thimble type with the added features of the curved base. This base prevents water from settling in or around the bolt hole and prevents the rotting of the cross-arm at this point. The depending lips of the base find a bearing on each side of the arm, prevent the pin from turning and offer a most substantial side strain construction.

The illustrations herewith show the complete pin assembled and the component parts of the pin when dissembled. By reference to these illustrations a clear idea may be obtained regarding the construction of the pin. The separate top or thimble A is designed for cementing into the insulator. This cementing may be done either by the customer or at the insulator factory. We recommend factory cementing because of the low cost and because insulators when received by the customer are at once ready for installation. This thimble is of malleable iron, cored and tapped to screw on to the upper end of bolt. The bolt B, is of solid drop-forged steel, either $\frac{5}{8}$ -in. or $\frac{3}{4}$ -in. diameter and of the proper length to suit the cross-arm in use, and is provided with a collar, which collar serves to hold it on a flange in base casting D, so keeping it from dropping out when it is installed on the cross-arm. Washer E and nut F of course go on the under side of the cross-arm, so allowing the bolt to be turned around as desired. The Keystone truss pin features are also provided in a ridge iron, and in a pole top pin. By using this assembly, the same insulators with separable thimbles cemented therein will fit either cross-arm, ridge iron or pole top pins. The great advantage of this fact will be readily appreciated.

Frink Reflectors and Specialties

The H. W. Johns-Manville Company, well known in the lighting field through the J-M Linolite System of illumination, have acquired the sole selling agency for the entire products of I. P. Frink. "Frink" reflectors and fixtures need no introduction to the lighting trade and consumers throughout the country, and this arrangement means that the H. W. Johns-Manville Company will be in a position to design and sell lighting systems for every known form of artificial illumination. An engineering department will be maintained along very extensive lines. This department will maintain a corps of engineers throughout the United States and Canada, and be equipped to place data and recommendations in the hands of all interested in any subject pertaining to illumination.

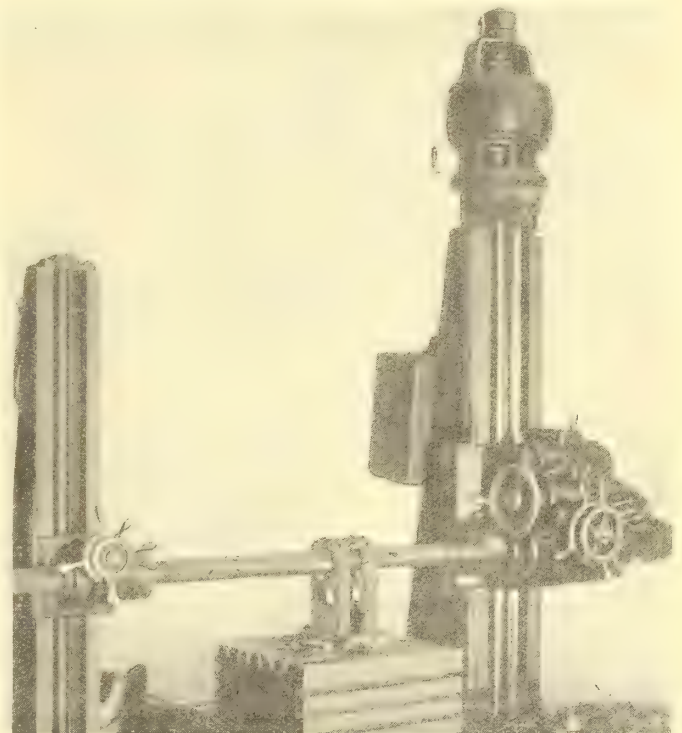
Prosperous Year for New Western Industry

The Canadian Carbon Company, of Winnipeg, formed for the purpose of making electrical dry batteries in Western Canada, has just completed the first year of its history. Until its factory was opened here at the beginning of last year, batteries for traction engines, farm engines, motor boats, automobiles, telephones, etc., had to be shipped from the east or imported from the United States. Starting in their own factory with a complete staff of experts in the making of electric batteries, the company were soon able to demonstrate to users the great advantage of buying batteries made in the west, and especially adapted to western climatic conditions. The result has been that they have captured practically the entire trade from Fort William to the coast. A particular advantage of buying dry batteries that are made in this portion of the country, is that they reach users shortly after being manufactured and therefore in a high state of efficiency. This is not always the case with batteries from the East or those which are imported from other countries, as the length of time taken for them to reach the user often means that they arrive with their power greatly lessened. The Canadian Carbon Company claim for their X Cell Battery that it possesses greater initial amp-

erage and will "live" longer than batteries made in Eastern Canada and the United States, and that this is borne out by the fact that the largest firms of traction engine builders use their cells exclusively.

Vertical Motor Drive for Boring Machine

Most manufacturers are believers in the importance of selecting an efficient drive for their machine tools. They recognize that the most direct or shortest distance between the source of power and the work means not only more work with less power, but also reduced operating costs by eliminating many superfluous lines of shafting with belts to each machine, dripping oil, and the difficulty of speed changing. By the use of individual electric drive, the machines may be located in the most convenient places for the work they are to perform rather than in a row and driven from one line shaft. The economy and flexibility of individual motor drive cannot be too greatly emphasized, since this form of turning power has been largely responsible for



the increased output of many and varied industries. In the building of machine tools, another important factor which is usually given careful consideration is the saving of floor space. This opens a new field for electric motors by mounting directly on the top of the machine to be driven. The electric motor is ideal for this purpose and has found especial favor with machine tool manufacturers due to its adaptability to direct mounting. It matters little whether the motor is mounted on a movable or stationary part, the drive will be equally efficient. High mounting also affords the operator plenty of space and at the same time keeps the motor remarkably free from dirt, chips and loose particles which often fall into the motor and do considerable damage. A particularly interesting and somewhat unique example of the manifold advantages of individual motor drive, applied to machine tools, is shown by the accompanying illustration. This is a motor-driven horizontal boring machine, built by the Rochester Machine Tool Company. The motor is a Westinghouse 5 h.p. vertical type R. The method of mounting the motor on the top of the column, as illustrated, is said to have proven particularly satisfactory in securing maximum efficiency.

Mr. Ellis Joins the Benjamin Electric Co.



Mr. Morgan P. Ellis, formerly sales manager of the Holophane Company of Canada, Limited, has accepted the position of sales manager of the Benjamin Electric Mfg. Co., Toronto, and will have entire charge of the sales of all products manufactured by that company. Mr. Ellis first came to Toronto last summer when the Holophane Co. of Canada, was organized. Before that time he had been connected with the Holophane Company in the United States as salesman in their north-west territory. His cordial manner, good-fellowship and ability have made him many friends since he came to Canada and their good wishes, as do those of his friends in the United States, follow him in his new work.

Electrically Heated Hydrants

The Simplex Electric Heating Company sends the following interesting item re electrically heated hydrants in Dawson City:—

There are 25 hydrants in the system, most of them "home-made," consisting of a 3-inch barrel connecting directly to the main, with no valve except at the two-way T joint at the top. Thus no provision is made for emptying the hydrant barrel after use. This is rendered possible by the precautions that are taken to prevent the hydrant from freezing. It is enclosed in an air-tight hinged box, while a Simplex electric heater keeps the temperature of the hydrant above 85 deg. Fahr. This heater consists of a small resistance coil enclosed in a band the size of a heavy dog-collar, fitting loosely around the hydrant and supplied with current from the lighting system. This simple device, cheap in both first-cost and operation, has to its record of several years' operation in temperatures of 50 to 60, and even 70 deg. below zero Fahr., only one frozen hydrant, which was situated at the only dead-end of the system, where lack of circulation and a blow-out fuse combined to make the hydrant an easy prey to a 60 deg. below zero temperature. This high efficiency is remarkable when one considers the number of hydrants frozen each winter in the eastern part of the Dominion, in a comparatively mild climate compared to that of the Klondike.

OB Lock Hangers

The Ohio Brass Company is listing several forms of round top hangers with a locking feature for giving, at all times, a tight joint between the hanger body and the boss



of the trolley ear. The locking feature is obtained by inserting a non-rotatable stud and a spring washer in a cup casting which is swaged over an anchor casting moulded into the insulation, thus anchoring the whole firmly in the outer body casting. The stud has a limited vertical move-

ment in opposition to the lock washer and, therefore, it is possible to screw the trolley ear onto the stud until the top of the boss on the ear is in contact with the cup casting of the hanger and then continue rotating the ear until it is in alignment with the trolley wire. This continued rotation, after the first contact, causes the lock washer to be compressed and this condition guarantees a tight joint at all times, thus eliminating vibration between the stud and ear boss and preventing the wearing out and stripping of threads. The hanger is furnished with $\frac{5}{8}$ -inch stud in two sizes of the form shown in the accompanying illustration and with a $\frac{3}{4}$ -inch stud in the form having the clips on the out-riggers turned upward.

A New Insulator from Sea-weed

A current issue of the Electrical Engineer describes a new insulating material called "seagumite," a product evolved, by a chemical treatment, from sea-weed. This material is described as a non-inflammable, impervious, leather-like, damp-proof, germ-proof and hygienic composition, unaffected by heat, cold, oils or exposure to weather. A very unusual property is noted, namely, that the insulating properties of seagumite are greatly increased after the material has been immersed for a short time in water, a property which suggests its value for submarine work. The dielectric strength is said to be extremely high, much higher than is ever likely to be required in practice. The resistance was found to be in the neighborhood of 30,000,000 megohms per cubic centimeter.

It is suggested that the uses to which this material can be put are practically unlimited. Motor and carriage tires and covers would have all the durability and cost only about one-third those in use at the present time. It can be used as a substitute for steam jointing and packing and even as a substitute for leather in the manufacture of boots, in which again it is claimed to be cheaper, more hygienic and more durable. It is also claimed that it is suitable for belting for machinery, possessing great textile strength and durability, non-inflammable properties and being unaffected by oils, chemicals or weather. In this connection it would also make an excellent material for roofing.

From Reciprocating Engines to Small Turbines

The advance of the small steam turbine has been remarkable. There seems to be no limit to the variety of uses to which it can be put. Statistics carefully compiled by one of the leading small steam turbine companies show that steam turbines are driving centrifugal pumps in over fifty-five different kinds of service while they are extensively used for driving generator sets, force draft blowers, gas blowers, cupola blowers, etc. Transitions due to the small steam turbine are daily seen and one which is rather interesting is the case of the Great Atlantic & Pacific Tea Company's plant at Jersey City. Three years ago this plant consisted of two 200 kw. Corliss engines direct-connected to generators. To this plant was added a 150 kw. Terry turbine-driven generator outfit. The results were so satisfactory that in 1910 one of the 200 kw. Corliss engines made way for a 200 kw. Terry turbine-driven generator set, and now the other Corliss engine is being replaced by a similar steam turbine set of 300 kw. This means that at this plant in three years a complete change from reciprocating engines to small turbines will have been made.

Treated with Avenarius Carbolineum

The Lindsley Brothers Company, of Spokane, Washington, dealers in poles, cross arms and ties, have received from the city of Lethbridge, Alberta, an order for 300 cedar poles and for from 25,000 to 30,000 street railway ties to be used

in the new municipal street car system. These ties are all to be treated with Avenarius Carbolineum by the "open tank" process. The company have a special machine of their own invention for treating these ties and are able to treat 2,000 per day.

This order marks the introduction of treated ties into Canada, though a number of the other municipalities and public service companies in the prairie provinces are considering the use of both treated poles and ties. Among the recent orders for poles received by the same company was one from the city of Hamilton for the major portion of the poles to be used in the installation of their hydro-electric system. This company has recently established a Canadian sales office at Calgary in charge of Mr. G. U. Bacon.

Cannot Reject Whole Output

After considerable time had been given to a study of the question, an important decision has just been rendered in an appeal raised by an electrical contractor in the United States against a ruling of an electrical inspection department, which had refused to permit the use of a well-known type of plug fuse. The electrical committee (better known as the committee of 22) of the National Fire Protection Association, Boston, has decided by a vote of twelve to ten in favor of the contractor and against the inspection department, thus maintaining the appeal. The refusal of the department to accept the fuse was made on the ground that although approved by the Underwriters' Laboratories and appearing on the list of approved fittings, some of this manufacturer's products were found to be defective in the field. The result of the decision is that an inspector can only reject such material as he finds defective and not the whole output of the manufacturer. The ruling will also hold in Canada.

New Brass Pendant Switch



The Benjamin Electric Manufacturing Co., Toronto, is placing on the market a new C-H brass shell pendent switch, the design of which is shown in the accompanying cut. This switch looks like a good sized acorn and it is claimed cannot be excelled in neatness of appearance. The switch mechanism is an absolutely new one and of ingenious design.

The ease of manipulation, facility in wiring, complete protection of the moving parts and separation of same from wiring cavity, long continued life in constant and hard service, and its great breaking capacity, makes it appeal to users of switches of this type. It is furnished either in brushed or polished brass.

Canadian Sunbeam Lamp Company Extensions

The Canadian Sunbeam Lamp Company, Limited, have let the contracts for a large addition to their works on Dufferin street, Toronto, and the extension, with equipment, will cost about \$250,000. The demand for the Sunbeam lamps has been so large and the present facilities are so fully taxed that it was decided by the directors to rush the building and equipment of this extension, so as to be in full operation in time for this year's fall trade.

Ornamental Iron Department of Canada Foundry

Owing to the remarkable growth in the business of the Ornamental Iron Department of the Canada Foundry Company, Limited, which has been conducted at the old Northey Pump Works at the King street subway, Toronto, the directors have decided to erect very extensive new works for this department of the company. All the plans and speci-

cations have been accepted, and the work will be rushed immediately the weather will permit. The new location will be adjoining the main works of the Canada Foundry Company at Davenport, and will occupy the block of land at the corner of Lansdowne and Royce avenues. When completed these works which will be specially constructed for ornamental iron, bronze and art metal work exclusively, should be equal to anything on the continent.

Reduction in Kingston Rates

A considerable reduction has been made in the power rates in Kingston, Ont. At present the rates are as follows: Up to 100 kw. hours per quarter, 10c. per kw.h.; above 100 and up to 150 kw.h. 9c.; above 150 and up to 400 kw.h. 7c.; above 400 kw.h. 5c.

Some time ago Manager C. C. Folger was asked to submit a new schedule of rates which would tend more towards the increase in the day load. These have been submitted as follows, and accepted by the Council: Up to 400 kw.h. 6c.; above 400 and under 500 kw.h. 5c.; from 500 to 750 kw.h. 4½c.; 750 to 1,000 kw.h. 4c.; 1,000 to 2,000 kw.h. 3½c.; 2,000 to 3,500 kw.h. 3c.; 3,500 to 5,000 kw.h. 2½c.; above 5,000 kw.h. 2c.

Minimize Danger from Ice Troubles

The installation of the hydro-electric plant at Renfrew is progressing satisfactorily. It is not expected that any ice troubles will be experienced, owing to the care with which the plant is designed. The rack is wholly submerged in order to prevent radiation, and at the entrance to the flume submerged arches similar to those used at some of the Niagara plants have been placed. The curtain wall above the arch, however, is inclined, in the Renfrew plant, at an angle of about forty degrees to the horizontal.

New Canadian Wire and Cable Company

Owing to the steady increase of their Canadian business, the Boston Insulated Wire & Cable Company, one of the best known manufacturing firms of its kind on the continent, has located a new Canadian plant at Hamilton, Ont., from which they are now filling their Canadian orders. They are manufacturing a complete line of rubber covered wires and cables for power, light and telephone work, incandescent lamp cord, flexible switchboard cables, and special cords and cables for all electrical work.

Mr. Strickland Leaves Underwriters' Association

Mr. H. F. Strickland, chief electrical inspector for Ontario of the Canadian Fire Underwriters' Association, is severing his connection with the association to take up similar work for the Hydro-electric Power Commission of Ontario. It is understood the Ontario Government will establish and maintain a series of regulations governing the installation of electric wires and apparatus and of which Mr. Strickland will have charge. The wisdom of this action on the part of the government as well as their choice of an inspector will be conceded by all.

Recent Publications

A pamphlet has just been issued by the Great Waterways Union of Canada containing the report of an organization meeting held by this Union in Berlin, Ontario, on January 11th, 1912. The subjects discussed were the Inland Waterways of Canada in general, with special reference to ocean navigation by way of the St. Lawrence and Welland Canal. It was held that the Georgian Bay Canal route was impracticable. The pamphlet also contains a treatise on the subject of waterways by D. B. Detweiler, of Berlin, Ont.

Escher Wyss Turbines at Stave Lake

The first large unit installed by the Western Canada Power Company, at Stave Falls, B.C., was recently placed in operation. This is stated by the manufacturers to be the largest unit yet installed in Canada excepting only some at Niagara Falls. We have reports to the effect that the plant was not shut down at all after its first start, indicating the reliability of the equipment and the care with which it was installed. The second unit is now in place. Both of these first two hydraulic units have 13,000 h.p. capacity working under a head of 110 feet. The hydraulic equipment is Escher Wyss manufacture and the electrical, C. G. E. manufacture.

Holds Agency for Eye Comfort System

Mr. Geo. J. Beattie, electrical engineer and contractor, is now handling and installing the Eye Comfort system of indirect illumination in Toronto and vicinity. This system has been attracting a great deal of attention both in the United States and Canada. A number of Eye Comfort fixtures such as manufactured by the National X-Ray Reflector Company, of Chicago, are now on exhibition at No. 72 Victoria street, and a typical installation may be inspected at the Globe newspaper office. A large number of these fixtures is carried in stock. Mr. Hans W. Gerhard is assisting Mr. Beattie as sales engineer.

Considering Ornamental Standards

The city council of Calgary are at present considering the installation of a new system of electric lighting, which, if it meets with approval, will mean that the ratepayers will be asked to authorize the expenditure of \$100,000. It is proposed to light Baker street and the business blocks on Ward street with five large globes on iron posts, placed three in each block, with a high power tungsten lamp in each of the five globes, thus providing a system similar to those in operation in the larger coast cities.

Siemens & Escher Wyss Equipment for India

An order has just been received by the Siemens Bros. Dynamo Works for four 11,000 h.p. 3-phase, 300 r.p.m. water-wheel generators, for the Tata Hydro-electric Power Supply Company, Bombay, India. These generators will be designed for an eighty per cent. speed increase. The order includes one 475 h.p. d.c. water-wheel type exciter and one 350 h.p., 3-phase generator with direct coupled exciter. The hydraulic equipment is all being supplied by the Escher Wyss Company.

Went Through Equitable Fire

The Stromberg-Carlson Telephone Company are justly very much pleased with the operation of one of their Mine-a-phones which went through the recent Equitable Life Building fire in New York city. It appears that this Mine-a-phone was situated on the third storey in the hottest of the fire, and came through absolutely unharmed. This seems to be sufficient proof that the company's claim that this piece of apparatus is fireproof, waterproof and gas-proof is correct.

Siemens Motor-Generators Ready for Operation

The two 500 kw. motor generator sets which are being supplied by the Siemens Bros. Dynamo Works for the city of Winnipeg are now ready for operation. This equipment is 2,200 volt, 60 cycle on the motor side and 550 to 605 volt d.c. on the generator side. Operation is at 720 revolutions per minute. The motors are of the synchronous type with the exciter on the same shaft. The d.c. current will be used for power supply throughout the city.

International Waterways Commission in Session

The three members of the Canadian section of the International Waterways Commission are now in the United States where considerable work has been done on the rules and regulations which are to govern the procedure in the various important matters which will come up for discussion. The waterways to be discussed include some western boundary rivers, the St. John River, N.B., and the St. Lawrence River.

B. C. E. R. Order Dick-Kerr Generators

The B. C. E. R. Co. have recently awarded contracts for the addition to their generating equipment at the North Arm of Burrard Inlet, of three 14,000 h.p. turbine units. These will be of the Doble impulse type supplied by the John McDougall Company. The generators are being supplied by Messrs. Dick, Kerr & Company, of England, whose agents in Canada are Chapman & Walker, of Toronto.

J. J. Martindale Has Agency

Mr. James J. Martindale has arranged to represent Thomas & Smith Inc., of Chicago, and will handle their pumping equipment in Ontario and Quebec. The line consists of centrifugal and plunger pumps manufactured in practically all the various combinations known to engineers. Mr. Martindale has offices at No. 112 Mail & Empire Building, Toronto, Can.

Canadian Tungsten Notes

Mr. J. W. Moncur, Montreal manager of the Canadian Tungsten Lamp Company, has just completed his tour through Nova Scotia and the Maritime Provinces, and has had a most successful trip, having booked up several car loads.

Messrs. T. McAvity & Sons Limited, the well-known dealers in St. John, have taken over the agency of the Canadian Tungsten Lamp Company for the Province of New Brunswick, and will carry a full stock of all lines.

Mr. A. L. Woolf, Winnipeg manager of the Canadian Tungsten Lamp Company, was unable, owing to stress of business, to take his usual Christmas trip to New York. He anticipates leaving Winnipeg to cover his western ground the first week in March.

Miscellany

The Packard Electric Company are moving their offices from the Saturday Night Building to more convenient and commodious quarters at 901-2 Traders Bank Building, Toronto.

The city of Halifax has under consideration a Bill which they will endeavor to have passed by the Legislature, under which it will be impossible for the Halifax Electric Tram Company to merge with any other corporation.

The Canadian Carbon Company are exhibiting at the Toronto Automobile Show, which takes place from February 21st to February 28th. They also exhibited at the Ontario Hardware Association Exhibition, held in Guelph, February 19th to 23rd.

At Quebec, Hector Beaudet has been sentenced to three years in the penitentiary for stealing a number of articles. Beaudet represented that he was an electrical inspector of the Fire Underwriters' Association, and by this means secured entrance into the houses with a view to looking over the wires. He suggested a number of alterations, and when the various parties were not looking was able to steal a number of valuable articles.

The corporation of Three Rivers, P.Q., has asked the electrical department of the Fire Underwriters' Association to make a thorough investigation of their street lines, with a view to having the general condition of the overhead construction improved. The matter is under consideration.

The Canadian Pacific Railway Company are building two new steamships and have just placed an order for eight 157 kw. direct-current Siemens generators for use in these. The generators will be direct-coupled to Belliss & Morcom engines. This equipment of eight generators will be used one-half in each steamship.

Fire damaged the premises of the Electrical Maintenance & Repairs Company, Limited, Toronto, on February 10th to the extent of \$650. The plant was only slightly damaged and no interruption whatever was caused in the business.

New Companies

Railway Equipment Company of Toronto, Limited, has been incorporated with a capital of \$40,000 to manufacture and deal in electrical machinery supplies, railway equipment, etc., with head office at Toronto, Ont. The provisional directors are A. E. Day, Wm. Gilchrist and A. M. Garden, all of Toronto.

The British Columbia Power Company, Limited, has been incorporated with a capital of \$5,000,000 to operate and maintain electric works, generating plant, power works, etc., with head office at Calgary, Alta. The incorporators are L. H. Miller, E. S. Day, and Thos. Rankine, of Calgary.

The North River Electric Company, Limited, has been incorporated with a capital of \$90,000 to manufacture and deal in all kinds of electrical apparatus, to construct dams, bridges, power works, etc., with head office at St. Andrews East, Que. The incorporators are: J. J. Meagher, W. S. Johnson and J. W. Weldon, all of Montreal, Que.

The Tweed Electric Light and Power Company, Limited, have obtained a charter.

South Shore Power and Paper Company, Limited, has been incorporated with a capital stock of \$2,000,000 to carry on a lumber, timber and pulpwood business in all its branches and also to develop water powers, maintain and construct canals, reservoirs, docks, etc., head office of the company to be in the city of Montreal, and the incorporators include Rene Chenevert, H. L. Mitchell and Percy Gregory, all of Montreal.

New Line of Steel Frame Fan Motors Brought Out by Westinghouse Electric & Manufacturing Company.

The Westinghouse Electric & Manufacturing Company is this year introducing a new line of fan motors with steel frames instead of the usual cast iron construction. The motor frame, the base and the guard arms are made of drawn steel, instead of cast iron. Drawn steel combines great strength with minimum weight; these fan motors weigh from twenty to forty per cent. less than cast iron frame fan motors of corresponding sizes and are therefore much more easily handled and less expensive to transport. Moreover, this construction makes these fan motors more attractive in appearance,—the steel is drawn into graceful, harmonious lines, its surface is smooth and gives a lustrous finish, and the steel lends itself to a variety of beautiful metal finishes. The standard finishes are black enamel and black oxide, similar to gun metal.

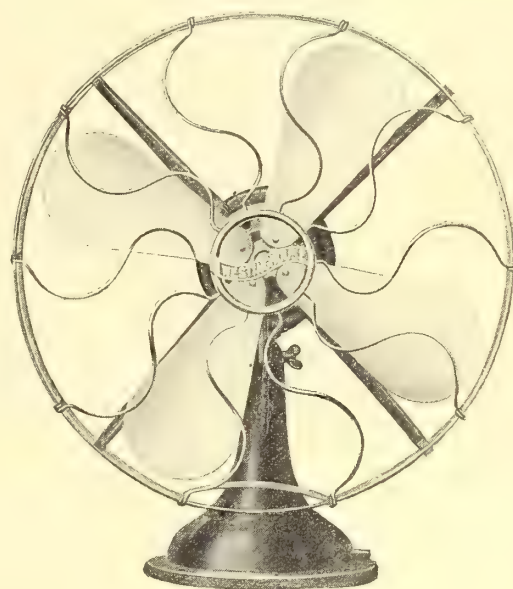
Another special feature of these fan motors is the swivel-and-hinge joint which connects the motor and the base. By means of this joint, the fan can be tilted within 105 deg. or rotated within 340 deg. in any direction and can be changed from desk to bracket mounting without the use of a trunnion, tools, or an adapter. All that is necessary to make any of these adjustments is to loosen a wing-nut; when the

wing-nut is tightened the fan is locked in position and can be neither tilted nor rotated.

All 25, 30, 50 and 60 cycle fan motors have three speeds and there is a marked difference in the effect of the fan at each speed. The speeds are controlled by a lever in the base of the fan which is firmly held at each running point and does not open the circuit between points. The fans will start and can be operated continuously on any point.

The motors for the drawn steel fans are of new design and show a low current consumption for the amount of air moved. This, too, has been accomplished without sacrificing the air output. The laminations are securely riveted together and are pressed into the motor frame, eliminating absolutely all humming or vibrating due to loose laminations. The single starting winding and the centrifugal cut-out switch are used as being the best possible means of starting, thereby eliminating probable burnouts, decreasing current consumption and giving more starting torque. The motor will start on its lowest speed, at its lowest rated voltage, and with the fan tilted forward or backward. The fan blades are the standard design. They are so shaped as to move the maximum amount of air with minimum noise and least expenditure of power.

Series wound motors are used for 25-30 cycles on account of their higher efficiencies for this frequency range and also because the torque is greater than in the induction type. Series motors also permit higher speeds on this



frequency, thus delivering more air. Imported brushes of large area and best quality are used. The fan motors have a heavy felt base, which is firmly clamped in place, similar to the base of a desk telephone.

The steel frame construction is adapted for residence use on account of its portability and handsome appearance which render it suitable for sick rooms, libraries, reading rooms, etc. The residence fan motors are practically noiseless in operation. They have six blades and the motors are slow speed. They are built in three types; desk-and-bracket, mechanically operated, oscillating and air-operated oscillating.

The Westinghouse line for 1912 is complete and includes fan motors for every purpose and for every commercial circuit on which fan motors are used. It comprises 8-inch, 12-inch and 16-inch desk-and-bracket, 12-inch and 16-inch mechanically-operated oscillating, 12-inch and 16-inch air-operated oscillating, 12-inch residence, 8-inch telephone booth, long sweep and 32-inch ceiling, counter column and floor column, and 12-inch and 16-inch exhaust or ventilating fan motors.

Current News and Notes

Allanburg, Ont.

A by-law has been introduced by the township council by which a 25-acre lot near lock 25 on the new Welland Canal will be practically relieved of taxes for a period of ten years, on condition that a pulp and paper mill be established on this property. It is said that the Ontario Power Company would supply power to the mill.

Acton, Ont.

Two by-laws were passed on Feb. 19, the first asking power to make a contract with the Hydro-electric Power Commission, the second asking authority to expend \$8,500 in an electric distribution system for this village.

Brandon, Man.

This city will issue debentures to cover an estimated cost of \$6,000 for street lighting extensions.

Barrie, Ont.

This town will ask authority to issue debentures to the amount of \$80,000 with which to construct a transmission line from the Simcoe Railway and Power Company's plant on the Severn River.

Bancroft, Ont.

The electric light plant was destroyed by fire on Jan. 25th.

Brantford, Ont.

The Hydro-electric Power Commission is submitting estimates of the cost of distribution of power in Brantford. Engineer Sothman recently made a rough guess of \$75,000. He advised that Brantford should apply for 2,000 h.p. and build accordingly.

Brampton, Ont.

This town contemplates installing motors for driving turbine pumps for use with Hydro power.

Calgary, Alta.

The second transmission line of the Calgary Power Company which will connect the generating station with the city is well under way.

Duncan, Ont.

A movement is on foot to form a company to supply Duncan with electric light and power. Steam equipment will be used in the meantime.

Edmonton, Alta.

The railway committee of the local government reduced the power of the South East Calgary Electric Railway Co. to issue bonds on its road from \$20,000 a mile to \$14,000 a mile. If the road is built it will probably run along the public highway. A clause in the charter asking power to generate and distribute electric power was not allowed.

By-laws were endorsed by the rate-payers, authorizing the expenditure of \$600,000, for street railway extensions, \$275,000 for telephone extensions, \$200,000 for power plant improvements.

Fredericton, N.B.

Mr. D. McLeod Vince, K.C., chairman of the New Brunswick Public Utilities Commission has announced that the consideration of the rates of the Fredericton Gas Light Co., which have

been submitted for approval, will be taken up on April the 18th.

In the investigation as to development of water power in this district, J. S. Armstrong, C.E., Fredericton, assistant engineer, plans to provide Gibson, St. Mary's and Marysville opposite here with electricity for heat, light and power.

Galt, Ont.

The town council through their hydro-electric department have decided to retail lamps to the consumers at such a price as will simply cover the cost to the municipality and the expense of handling.

Halifax, N.S.

Plans are being made to begin work early in the spring on a power development scheme at Whiterock Falls. This is a 12-foot fall situated on the Gas-pereau River where a dam has already been built. Above this point there is a 41-foot fall in about $2\frac{1}{2}$ miles and it is proposed to utilize the whole fall by the construction of a number of dams and a canal $2\frac{1}{2}$ miles long.

Hamilton, Ont.

A special street railway committee has been named by the city council to deal with the local railway problem. It is said that inspectors are being appointed and placed at various points over the city to check up the schedule and the amount of traffic.

It is said the Bell Telephone Company will erect a large new building in this city.

The Hamilton, Waterloo & Guelph Railway Company. Interested, Sir Robert Perks, head of English syndicate. Contractors to build road, McArthur Bros., New York; Engineer Sloan. Work to proceed in spring. First link to Galt finished by July, 1, 1913.

Halcyon, B.C.

Equipment has been ordered and is expected soon to arrive for the installation of an electric light plant here which will supplement the present gas-line lights and supply the village with power as well.

Hartland, N.B.

A Hydro-electric plant is proposed on the Becaguimach River by Mr. A. R. Rigby. By this point there is a 20 foot head and a possible minimum development of 300 h.p.

Kindersley, Sask.

Proceedings are being taken for the installation of a municipal electric light and power plant. Between \$10,000 and \$15,000 will be spent on the project this year.

This town is planning to install a \$15,000 electric light and power plant.

Kingston, Ont.

The utilization of electric power for water pumping apparatus is being discussed here.

Manager C. C. Folger has reported a net surplus in the light, heat and power department for 1911, of \$10,317. Forty a.c. meters will be installed, it being

the intention to gradually change over from d.c. to a.c.

Kamloops, B.C.

Engineer R. S. Lea made a complete report on the development of 2,000 h.p. at the Barrier River having in view an ultimate requirement of 10,000 h.p. The information obtained by Mr. Lea was used in conjunction with a recent report by the engineering firm of Dutcher Maxwell & Co. The development work will proceed at once under the supervision of the latter engineers.

London, Ont.

The plans for the London and North Western Radial Railway Co., which proposes to generate power from a water fall at Rock Glen on the Sabie River are not yet complete, but Mr. D. A. Stewart states that good progress is being made.

The charge is made here that the Hydro-electric Commission is not charging a uniform light or power rate to its customers and that the rate is cut wherever necessary to secure business. This is naturally looked upon with disfavor by those who pay the higher rate.

Application will be made to the legislature to validate a by-law for the expenditure of \$50,000 for an incinerator and electric generating plant. \$90,000 is also being asked for electric light extensions.

Montreal, Que.

Explosion followed by fire damaged plant of Wire & Cable Co., Guy street, Montreal, recently to the extent of \$4,000.

The financial statement of the Shawinigan Water & Power Company shows a gross income for the year 1911 of \$1,349,715, net \$754,512. This is a little over $7\frac{1}{2}$ per cent. on the present capital of \$10,000,000. The gross is an increase of \$358,685 over a year ago and the net is nearly double that of 1910, being an increase of \$345,257.

Merriton, Ont.

Announcement has been made that a branch factory of the Presto Light Co. will be located here for the manufacture of lights for automobiles, carriages, boats, etc.

Medicine Hat, Alta.

A bill will be introduced in the local legislature at Edmonton giving power to the Medicine Hat Electric Railway Co. to construct and operate an electric belt line including Dunmore and Elkwater.

Moncton, N.B.

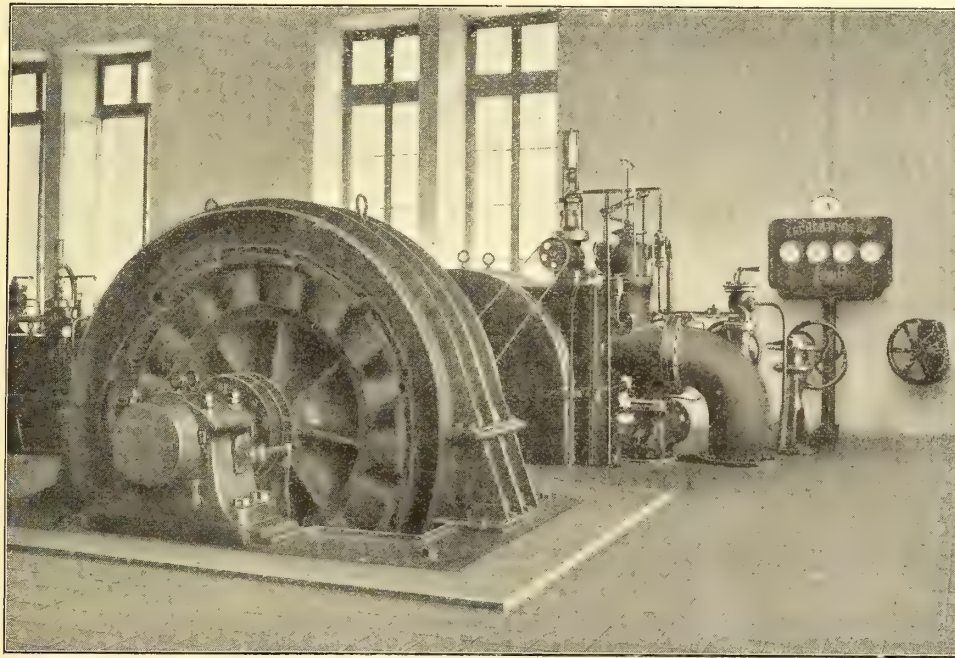
It is reported that a large portion of the stock of the Moncton Tramways, Electricity and Gas Company has been sold to a financial syndicate operating in New York and Pittsburgh.

Nanaimo, B.C.

The tramway committee of the city will apply to the legislature for power to build, construct, operate, etc., a belt line tramway system connecting this

(Continued on page 76)

SIEMENS



One of a number of Siemens horizontal water wheel generators in Power Station which has been in satisfactory operation since 1903. Output of each generator 900 K.V.A. at 375 R.P.M.

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Berlin

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Vienna

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Branch Office: 707 McArthur Building, WINNIPEG

city with Brechin, Northfield, East Wellington and Extension.

The Electric Railway Construction Co., with head office in Vancouver may enter the competition for a franchise to build an electric road here. Other offers are expected from a British syndicate who will make investigations, and from the B. C. Hydraulic Co.

Niagara Falls, Ont.

The Fire, Water & Light committee require sixteen 48 hr. alternating current arc lamps.

The council here recently passed a strong resolution calling on the Provincial Government to do all in its power to prevent the exportation of any more electric energy to the United States.

North Toronto, Ont.

The municipal corporation of North Toronto has made application to the local legislature asking power to prohibit freight carrying on Yonge street, by the Toronto and York Radial Railway Co.

New Westminster, B.C.

The B.C.E.R. Co. have let the contract for the lengthening of their big river towers. During the past summer some trouble was experienced by vessels with tall masts and the wires will now be kept at least 225 feet above the high level mark of the river.

Nelson, B.C.

Mr. J. E. Taylor, president of the Nelson Street Railway System, states that the receipts during the past six months have been almost as great as during the whole of the year 1906 and adds that he believes the time is not far distant when dividends will be forthcoming.

North Battleford, Sask.

Extensions to electric lighting system in charge of Chipman & Powers, Engineers, Toronto and Winnipeg.

New Westminster, B.C.

The International Railway & Development Company propose to construct a line from Ladner to New Westminster and on through White Rock to Blaine and Huntingdon.

Ottawa, Ont.

Approval of the plan of the Isle au Heron Development Co. has been delayed until the departmental engineers or the commission recently appointed to have charge of St. Lawrence water-power developments shall have time to report fully.

A recommendation will go to the Electric Commission to have lights extended on Sparks street from Bank to Lyon.

At a recent address in Eganville the Postmaster-General, the Hon. Mr. Pelletier, stated that the Dominion government's programme included a national system of telephones and telegraphs, the operation of which would come under the post-office department.

Permission is being asked by the municipal electrical department to issue debentures to the amount of \$70,000, to lay conduits on Sparks street and to extend the lighting system of the city.

The Ottawa Electric Railway will double track Wellington street up to Bank street to relieve traffic congestion on Sparks street. Work will proceed on

completion of the Laurier Plaza in front of post office.

The Ottawa, Smith's Falls and Kingston Railway Company, is asking power to change the company name to the Ottawa Rideau Lakes and Kingston Railway Co. They also ask an extension of the time when the construction of the road must be commenced.

The Gloucester Township Council has closed a contract with the Ottawa Electric Co. for the supply of 20 arc lights which will be placed along the country road.

The Street Railway Extension Committee, acting under the advice of City Engineer N. J. Ker, has approved an outlay of \$280,000 as follows: cost to railway company for track equipment, \$204,000; cost to city for road grading, \$76,000; single track mileage 15.85 miles; street mileage, 7.22 miles.

Oshawa, Ont.

Electrically driven turbine pumps and castings, for connecting to existing intake pipe and well, as well as pole line and equipment (2 miles) are required, estimated cost \$3,500.

Port Arthur, Ont.

On February 20th the ratepayers approved the following by-laws: Double tracking of street railway, \$11,000; constructing a siding at the fair grounds, \$5,600; extending street railway lines, \$6,500.

Peterborough, Ont.

Following the request for an extension of the Peterborough Railway System to East City the company has replied that they will go into the matter and give an answer at an early date.

Alderman Gordon at a recent meeting of council raised the question of taking over the street railway system and operating it as a municipal plant.

Portage la Prairie, Man.

The Lake of the Woods Milling Co., head office, Montreal, is said to require new engines to be installed next summer to replace present 500 h.p. plant.

It is said the Great Falls Power Co., of Winnipeg, engineer, C. Chamberlain, will build a transmission line from Winnipeg to Portage la Prairie if the town will contract for 1,000 h.p. for 30 years. The company would buy power from the Winnipeg plant, transmit at 60,000 v. and step down to 2300 v.

Revelstoke, B.C.

The city of Revelstoke is offering for sale two 2,500 light generators in first class order, complete with exciters, meters, belts, etc.; sold singly or together.

Regina, Sask.

The possibilities of power development on a large scale using the wide spread deposits of lignite coal in Saskatchewan, formed the subject of a resolution brought forward by Mr. George Bell of Estevan in the Legislative Assembly of that province recently. Mr. Bell's resolution was as follows: "That in the opinion of this house the Government should take such steps as are necessary to obtain full information respecting: (a) The feasibility of developing and transmitting electrical power generated at the coal fields of Saskatchewan; (b) The most economical form and manner in which lignite coal

might be used as a fuel for domestic purposes."

St. Pacome, Que.

River Ouelle Pulp & Lumber Co., require a lighting plant for logging camps. Water power not available. W. Gerard Power, Manager and Secretary, St. Pacome.

Strathcona, Alta.

For the month of December the city electric light department showed a surplus of over \$8,000. The telephone department also showed a surplus of \$1,653, but the street railway system shows a deficit, though this has been gradually diminished to about \$800.

Superintendent Ormsby, of the electric light department has announced a reduction in Strathcona lighting rate from 12c to 8c. per kw.h. This is the result of the amalgamation of Strathcona with Edmonton. The power rates have been reduced in Strathcona by 1c per kw.h.

St. John, N.B.

The possibility of developing electric power by using the Queens County coal area is being discussed. The plan followed would probably be to build coke ovens in which the slack coal would be made into coke. The railroads would take the screened coal and on the gas, which is the by-product of the coke-ovens, would be used for heating the boilers to operate the dynamos or gas-engines may be used.

Spdney, N.S.

A by-law will be submitted asking the opinion of the electors on the question of city ownership of the lighting system.

Toronto, Ont.

A bill has been introduced in the Ontario Legislature dealing with the grievances of motormen and conductors on street cars. The bill gives the Railway Board authority to regulate the working hours of these employees.

A conference of all the municipalities in Ontario interested in the hydro-electric system was convened on Feb. 22nd by Mayor Geary for the purpose of discussing questions relative to electric distribution in these municipalities.

The city council interprets the franchise of the Toronto Electric Light Co. to apply only to the old city limits as they existed in 1889. Following this interpretation they have notified the company that no poles must be placed on the streets of the newer city area without the consent of the city council, which means, of course, that it is the intention of the city of Toronto to prevent competition with their municipal distribution system in the newly acquired parts.

The city's share of the Toronto Street Railway Company's earnings for the month of January amounted to \$52,838. This is more than double what the city was receiving 6 years ago showing the tremendous advance in the revenue the city is deriving from this source.

Victoria, B.C.

On February 1st the power rate, 1.07c. per kw.h., which was some months ago promised by the Vancouver Power Company, came into force. This rate was to be given as soon as the Jordan River plant could be completed. This city favors the use of arc lights for street illumination and already operates

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A Full Line of Alternating Current Switchboard Indicating Instruments

is offered by this Company, comprising:

**WATTMETERS, Single and Polyphase.
POWER FACTOR METERS.
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**FREQUENCY METERS.
VOLTMETERS.
AMMETERS.**

and New Models of Weston D.C. Instruments to match

This whole group of instruments embodies the results of several years exhaustive study and scientific investigation of all the complex electrical and mechanical problems involved in the development of durable, reliable, sensitive and accurate instruments for use on alternating current circuits.

Every detail of each of these instruments has been most carefully studied and worked out so as to be sure that each shall fully meet the most exacting requirements of the service for which it is intended. Neither pains nor expense has been spared in the effort to produce instruments having the longest possible life, the best possible scale characteristics, combined with great accuracy under the most violent load fluctuations and also under the many other trying conditions met with in practical work. Every part of each instrument is made strictly to gauge and the design and workmanship and finish is of the highest order of excellence.

We invite the most critical examination of every detail of each member of the group. We also solicit the fullest investigation of the many other novel features and very valuable operative characteristics of these new instruments and request a careful comparison in all these respects with any other make of instrument intended for like service. We offer them as a valuable and permanent contribution to the art of electrical measurement. Their performance in service, will be found to justify the claim that no other makes of instruments approach them in fitness for the service required from A.C. Switchboard indicating instruments.

Full particulars of design, construction, prices etc., are given in Catalogue C.E. 16. Write for it.

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Power Building, Montreal

nearly 600 of them. Chief Electrician Hutchinson estimates that 1,500 will soon be required.

Vancouver, B.C.

The B. C. Conservative Association recently appointed a deputation to wait on Premier McBride with the suggestion that the provincial government should confer with the Dominion government regarding the establishment of a government telephone system. It is said that Premier McBride was favorably impressed with the idea and promised to act along these lines.

A small dam near Union Bay belonging to the Canadian Collieries Co., and used by them in generating power for their plant burst on Feb. 11th and flooded the valley below destroying a number of villages and it is believed that several persons were lost.

Messrs. Stone & Webster, of Boston, have notified the Western Canada Power Company that they will require from 5,000 h.p. to 6,000 h.p. Contracts have also been closed to supply 1,500 h.p. to the Heaps Lumber Co., at Ruskin and Vancouver, B.C. The British Columbia Wire Nail Co. has just signed a contract for 400 h.p.; the C.P.R. quarry at Vancouver, for 350 h.p.; the Port Moody quarry, for 250 h.p.; Clayburn brick yards, 500 h.p.; connections will also be made for the supply of the Grand Trunk Pacific wharves at Vancouver, B.C. The company has now completed about 35 miles of main transmission line at 60,000 volts, 50 miles of distributing lines at 12,000 volts; 38 miles of distributing lines at 2,000 volts, and 4 miles of underground mains in Vancouver City.

Wingham, Ont.

It is said the Western Foundry Company, Wingham, J. S. Cunningham, manager, will require new machinery, wiring, switchboard equipment, etc.

Moonlight Schedule for March 1912

Courtesy of the National Carbon Company, Cleveland (Ohio.)

Date.	Light.	Date.	Extinguish.	No. or Hours
Mar. 1	No Light	Mar. 1	No Light	
2	No Light	2	No Light	
3	No Light	3	No Light	
4	6 20	4	9 00	2 40
5	6 20	5	10 10	3 50
6	6 20	6	11 20	5 00
7	6 30	8	0 30	6 00
8	6 30	9	1 40	7 10
9	6 30	10	2 40	8 10
10	6 30	11	3 40	9 10
11	6 30	12	4 30	10 00
12	6 30	13	5 30	11 00
13	6 30	14	5 30	11 00
14	6 30	15	5 30	11 00
15	6 30	16	5 30	11 00
16	6 30	17	5 30	11 00
17	6 40	18	5 20	11 00
18	6 40	19	5 20	10 40
19	6 40	20	5 20	10 40
20	6 40	21	5 20	10 40
21	6 40	22	5 20	10 40
22	6 40	23	5 20	10 40
23	10 20	24	5 10	6 50
24	11 30	25	5 10	5 40
26	0 30	26	5 10	4 40
27	1 30	27	5 10	3 40
28	2 10	28	5 10	3 00
29	2 50	29	5 10	2 20
30	No Light	30	No Light	
31	No Light	31	No Light	
Total.....197 10				

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Positions Vacant } 2 cents a word per inser-
Miscellaneous. } tion.

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Forms close on the 18th of each month.

Situations Wanted

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Electrical Engineer, 10 years experience, desires position as Superintendent of Hydro-Electric Power House, or take charge of lighting and power of small town, East or West. Apply Box 420, Electrical News, Toronto, Ont.

Works Electrician desires change, present position eight years in charge of large industrial plant, accustomed to both A.C. and D.C. apparatus. Testing, Repairs, Installation, Maintenance. Good supervisor, can instruct or do work myself. Box 443, Electrical News, Toronto, Ont. 3

Municipal Electrical Superintendent with 12 years' American and Canadian technical and practical experience in up-to-date methods of plant maintenance and operation, transmission, line construction, high or low tension, distribution of services, installation of meters, motors, and other modern power appliances, arc or incandescent street lighting systems, desires change to a growing town or small city; can produce results; married, age 36 years, Graduate S. C. S. West preferred. All references. Box 392, Electrical News, Toronto, Ont.

Situations Vacant

SALES ENGINEER

Sales Engineer: Large Electrical Manufacturing Company wishes to employ two young men in the Machinery Sales Department, college training and shop experience required, selling experience not necessary, but such experience will be given extra consideration.

Apply Box 440, Electrical News, Toronto, Ont. 3-4

Sales Manager

A Sales Manager is wanted at once for a Wire & Cable Company, manufacturing in Canada. Must have had experience in electrical or kindred business in Canada, and must furnish "A-1" references.

Apply by letter to 502 Merchants Bank Building, Montreal. 3

Miscellaneous

Contract To Let

Parties having about 60 or 70 miles of heavy ballasting and trainfilling to do, are willing to sub-let the work to substantial people provided same will rent rolling stock, Lidgetwood and cars now on hand. Apply Box 402, Electrical News, Toronto, Ont.

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Ayr electric light plant in first class condition, steam power, good service and contracts. Exclusive franchise in town of 1,200. A splendid chance for a practical man. Being sold because of owner's death. Apply D. M. Clark, 15 Mc Kenzie Crescent, Toronto, Ont. 2-TF

Plant For Sale

Electric light plant and water power in Western Ontario, at present rented and in good running order. Also farm, on which plant is situated, suitable for grazing or cultivation. For further particulars apply to R. C. Pearce, Paisley, Ont., or D. McIntyre, 1943 Smith Street, Regina, Sask., proprietor. 3-6

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Electrical Equipment

Sealed tenders, addressed to the City Commissioners, and endorsed "Tender for Electrical Machinery," will be received up to twelve o'clock noon on Friday, March 8th, 1912, for the following apparatus:—

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5-Sets of Automatic Stokes.
Induced Draft Plant and Duplicate Fans for same.

Economizers for 2,000 H.P. capacity.
2-Feed Pumps.
All necessary equipment for the above.

1-2,000 KW. High Pressure Steam Turbine with Condenser, Air Pumps, and necessary equipment.

2-75 KW. Turbine Exciters.

1-Generator Panel.

2-Exciter Panels.

With all necessary cables and apparatus from Turbine to Switchboard.

Instructions to bidders and forms of tender will be furnished on application.

The lowest or any tender not necessarily accepted.

JAS. CLINKSKILL,

W. B. NEIL, City Commissioners.

E. M. SNELL,

Saskatoon, Sask., Feb. 8, 1912. 3

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Subscriptions are based on the service furnished and are available only by reputable wholesale jobbing and manufacturing concerns, and by responsible and worthy financial, judiciary and business corporations. Specific terms may be obtained by addressing the company or any of its offices. Correspondence invited.

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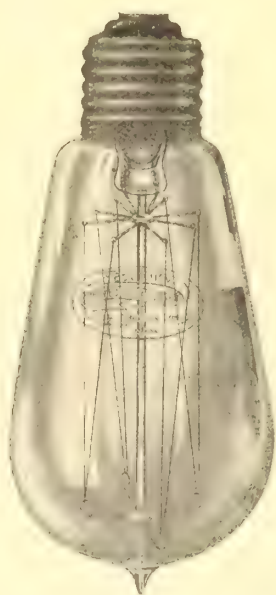


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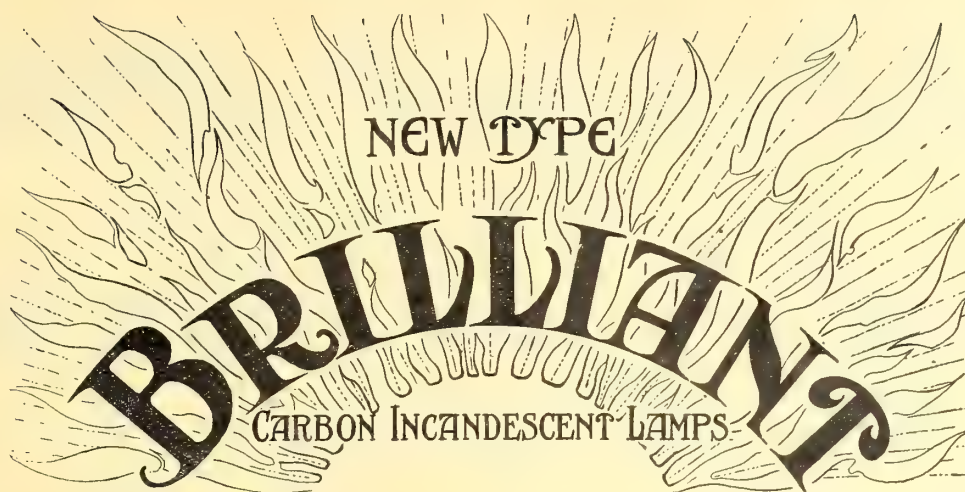
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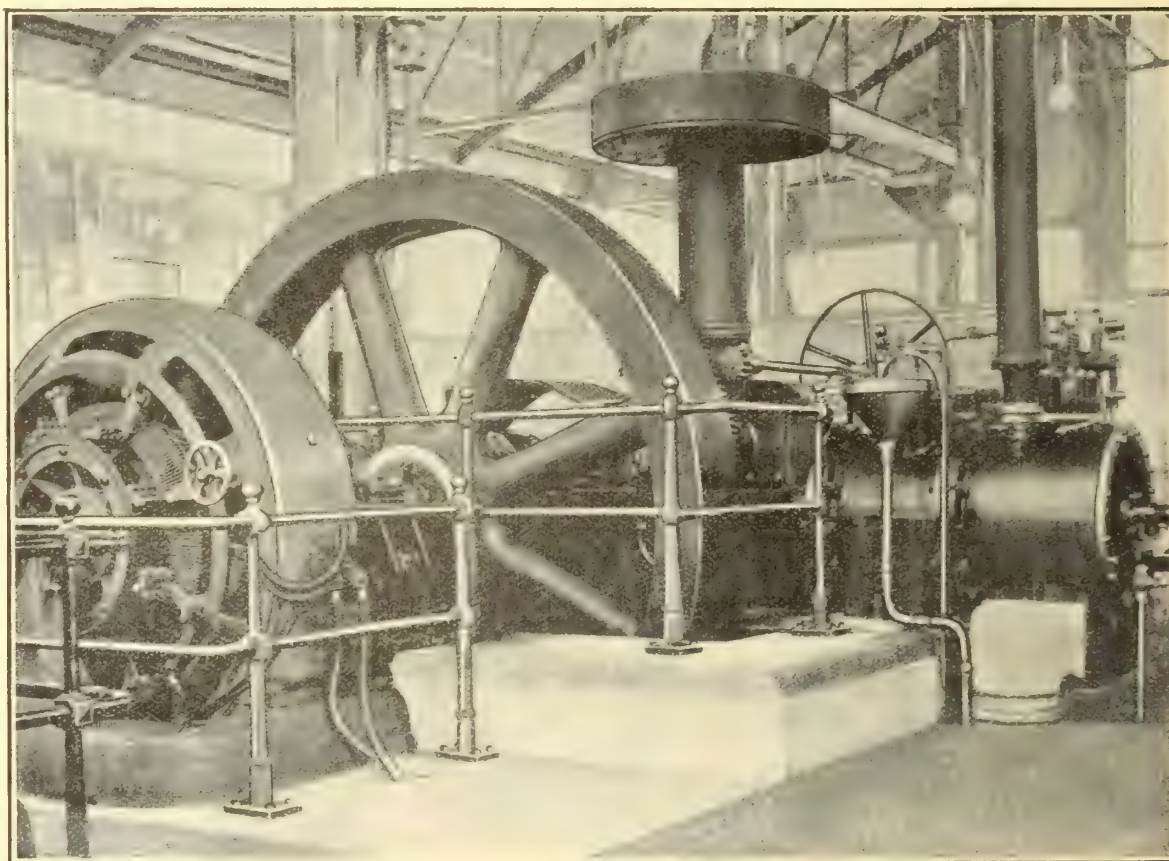
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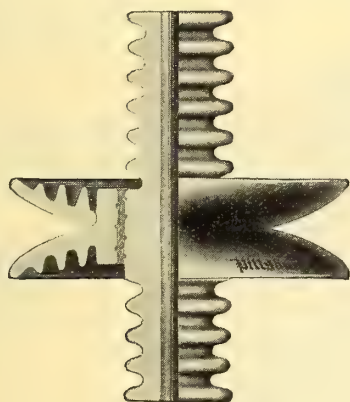
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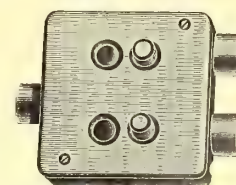
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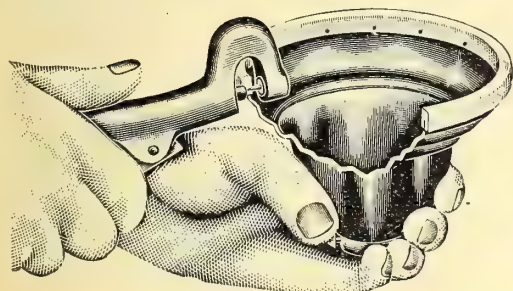


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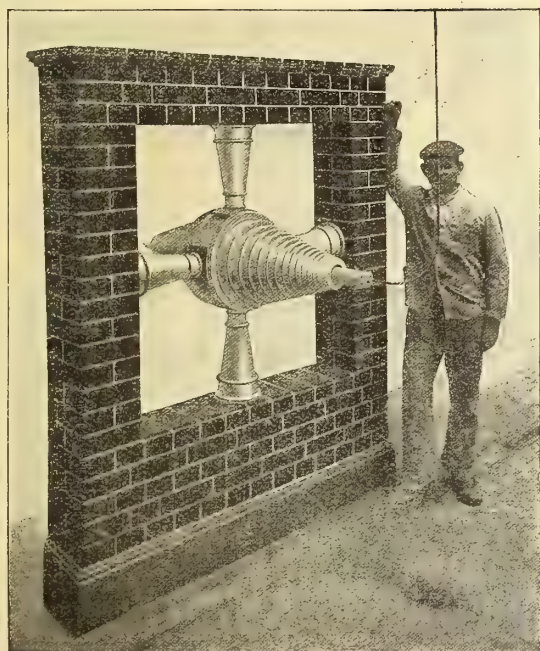
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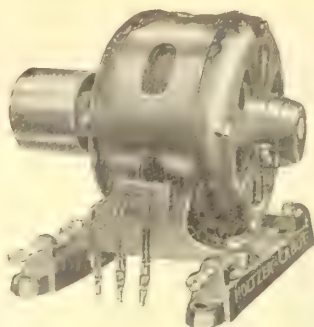
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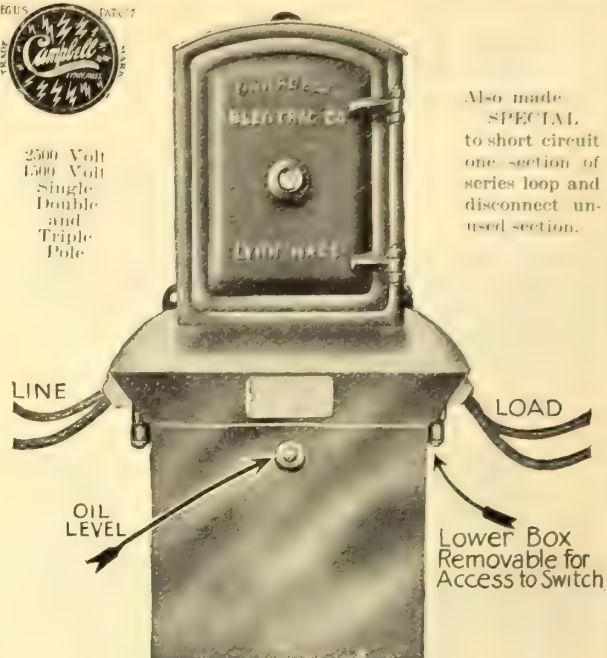
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Also made
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Scientific workmanship, superior construction and substantial material are put into Wakefield Lighting Fixtures before they are placed on the market and are not merely attributes given them in advertising.

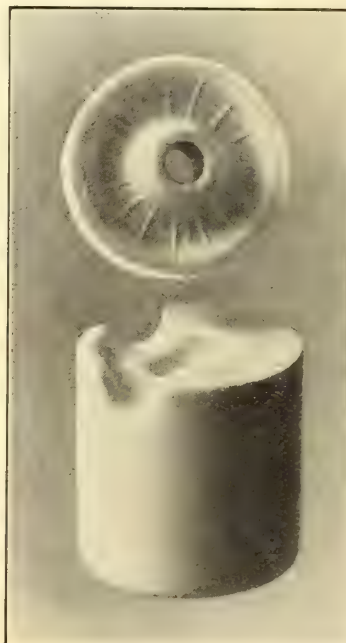
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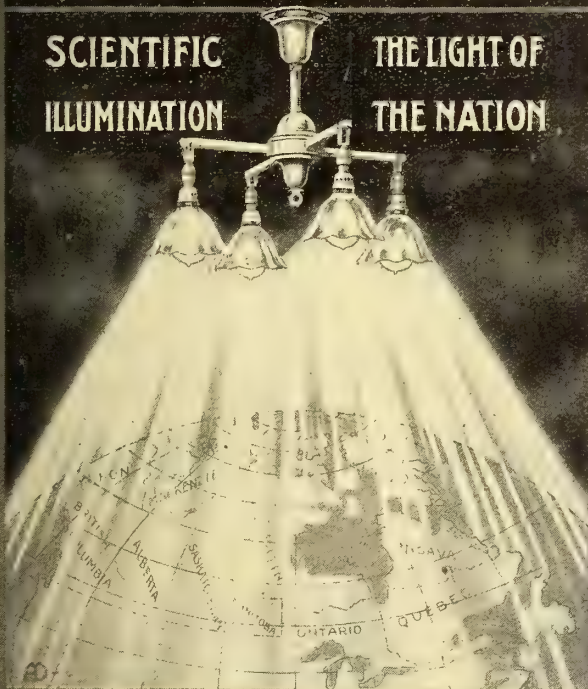
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SCIENTIFIC
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THE LIGHT OF
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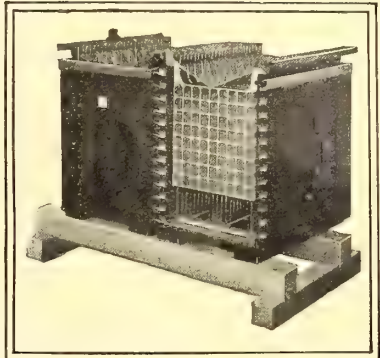
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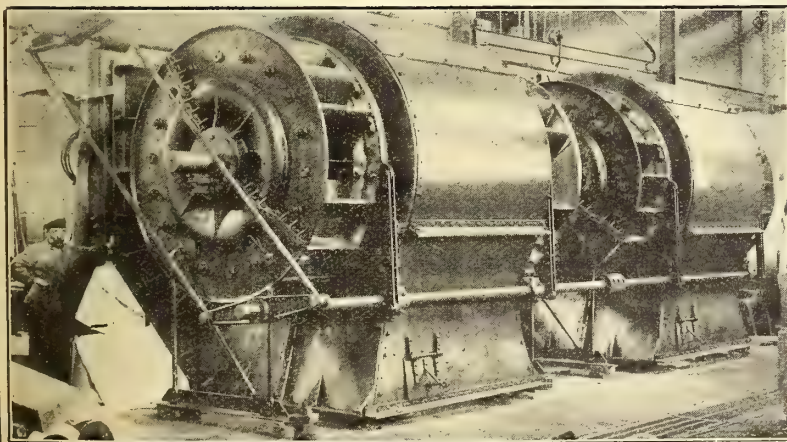
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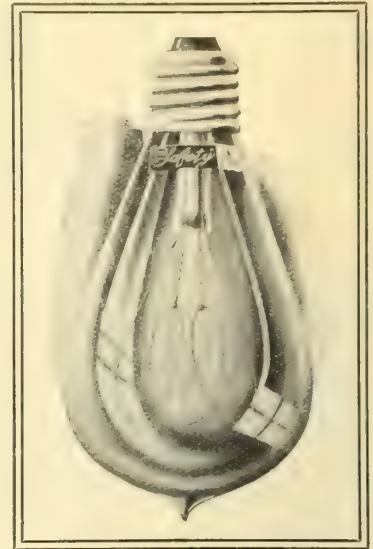
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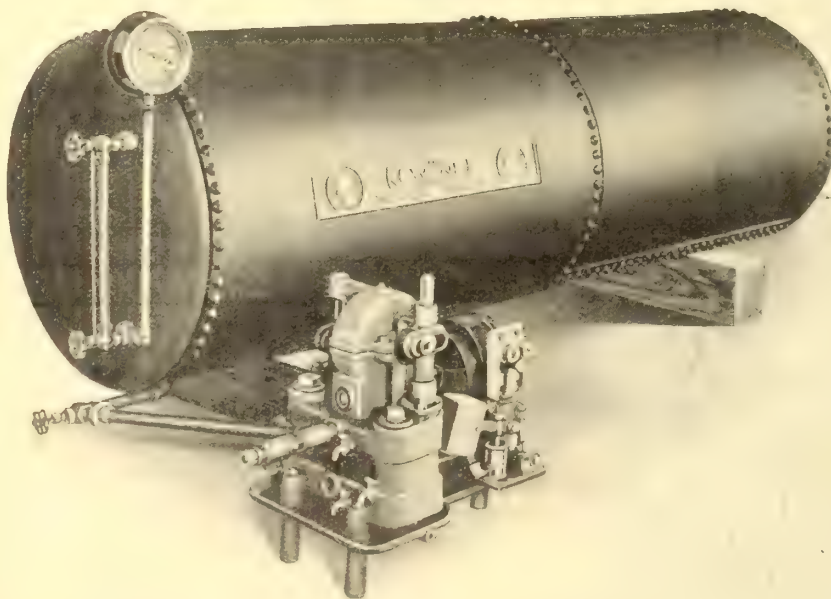
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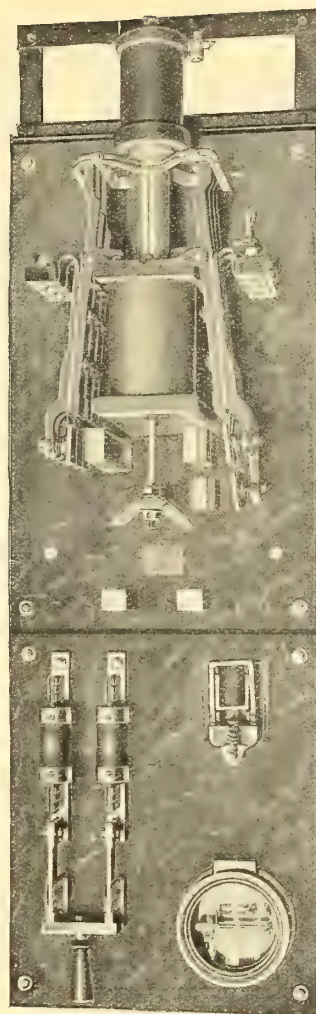
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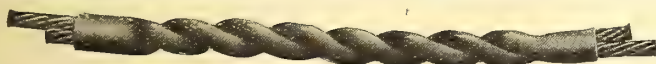
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These two catalogues, illustrate, briefly describe, with code numbers, all our standard apparatus and supplies.

Our line supply catalogue also tells you why certain types of material are best, gives installing and maintenance hints that are worth time and money to practical telephone men.

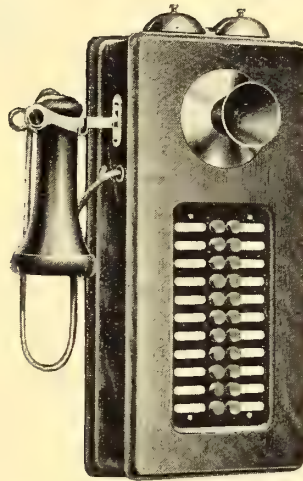
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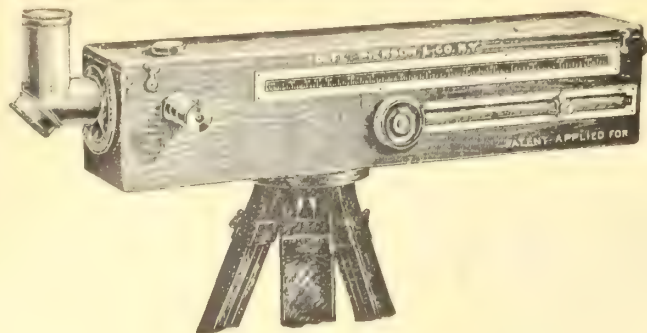
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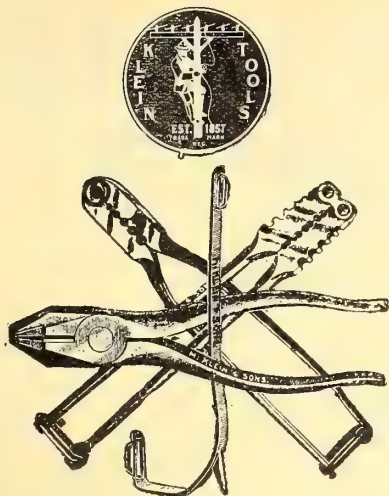
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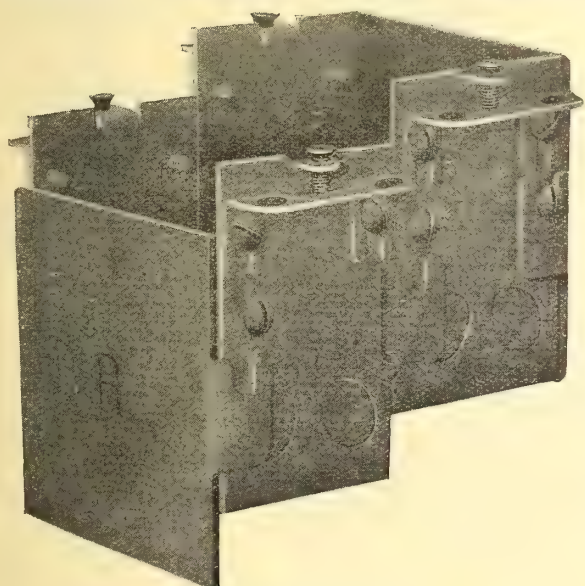
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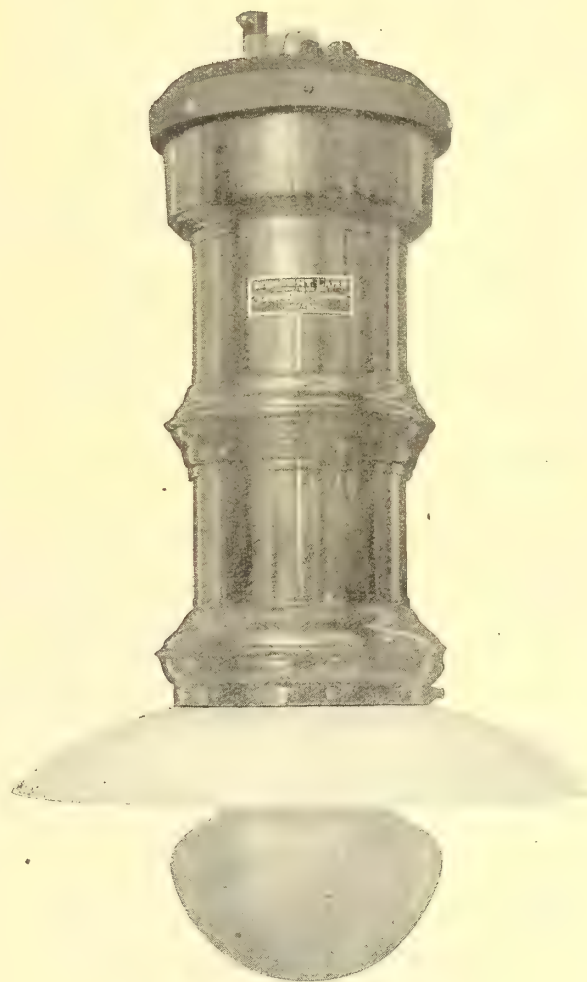
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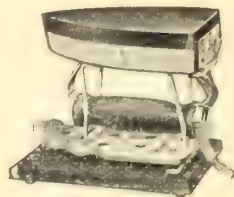
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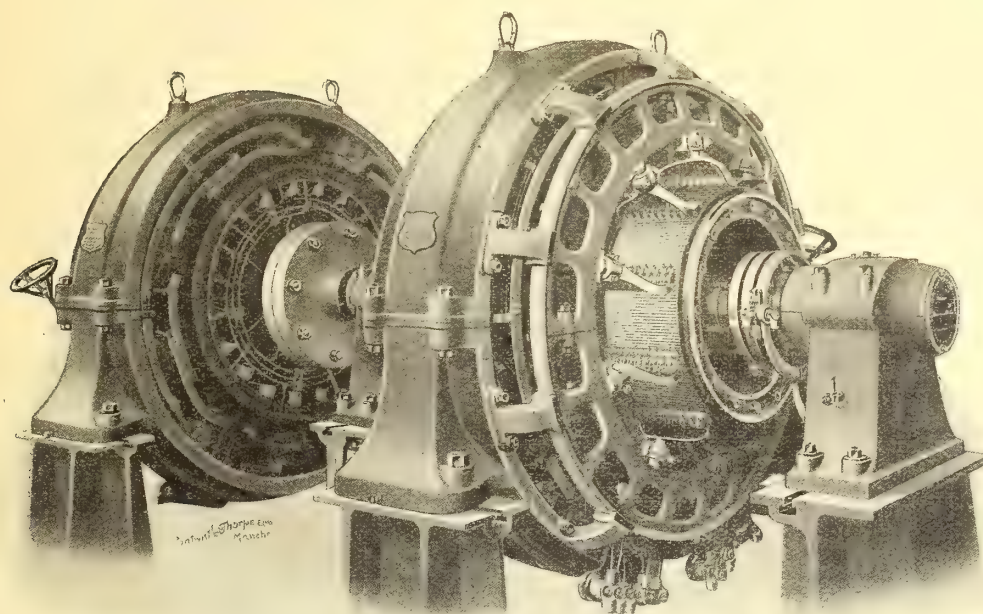
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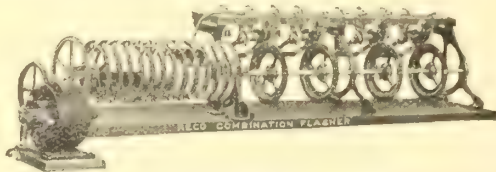
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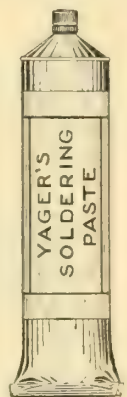
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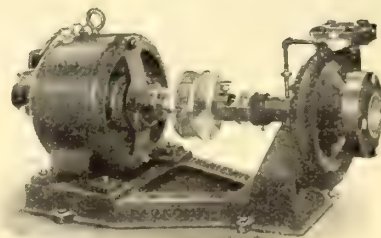
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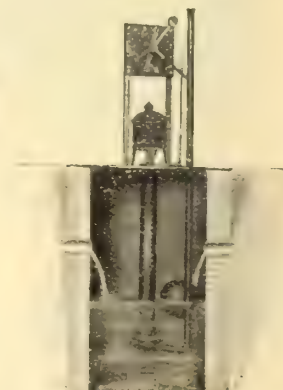
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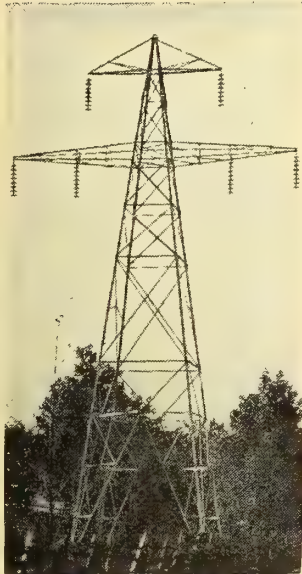


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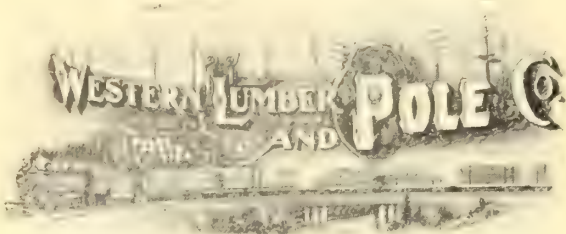
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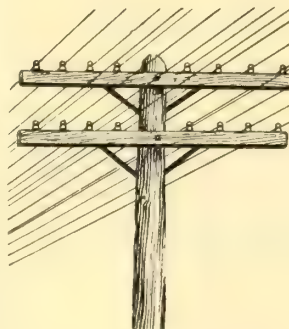
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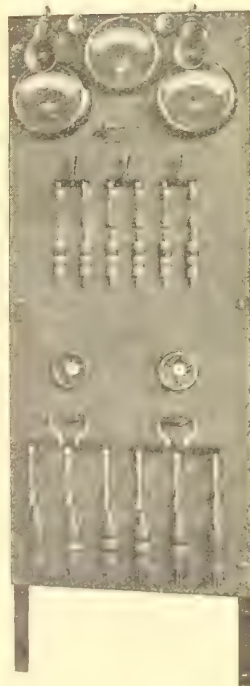
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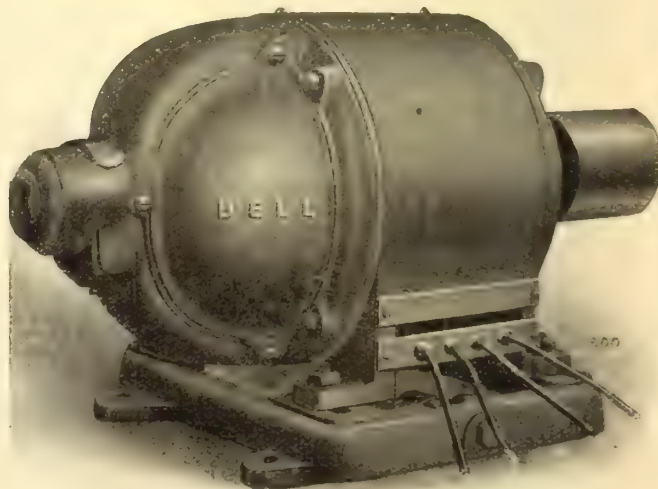
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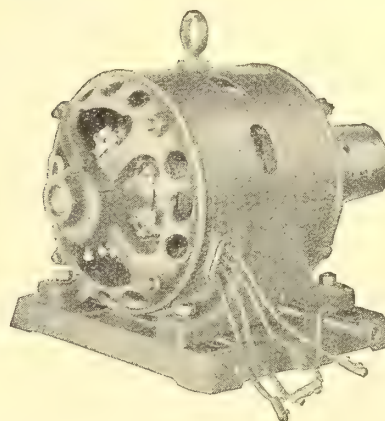
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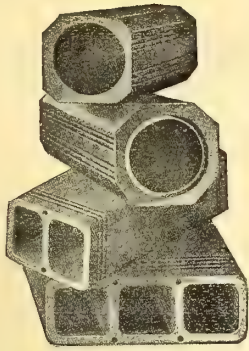
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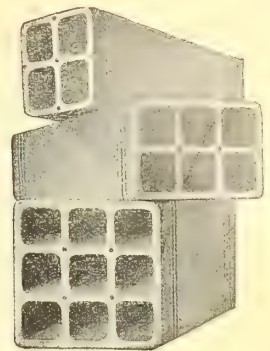
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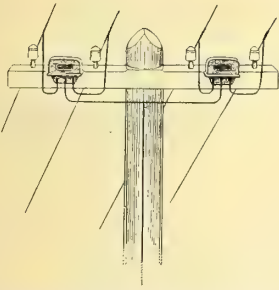
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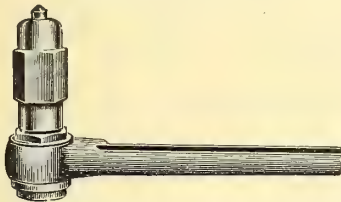
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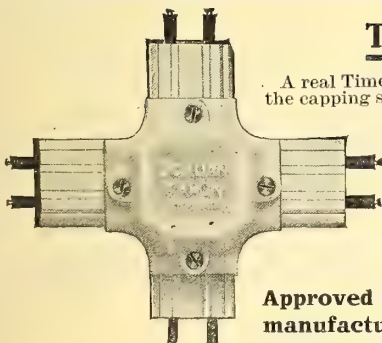


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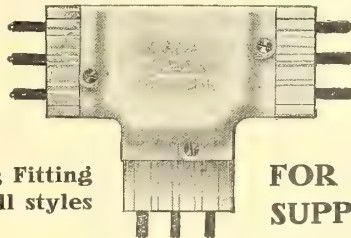
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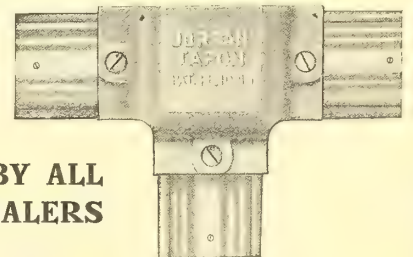
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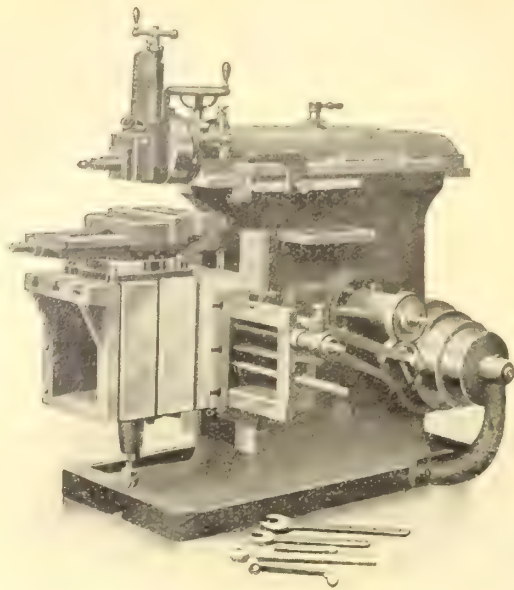
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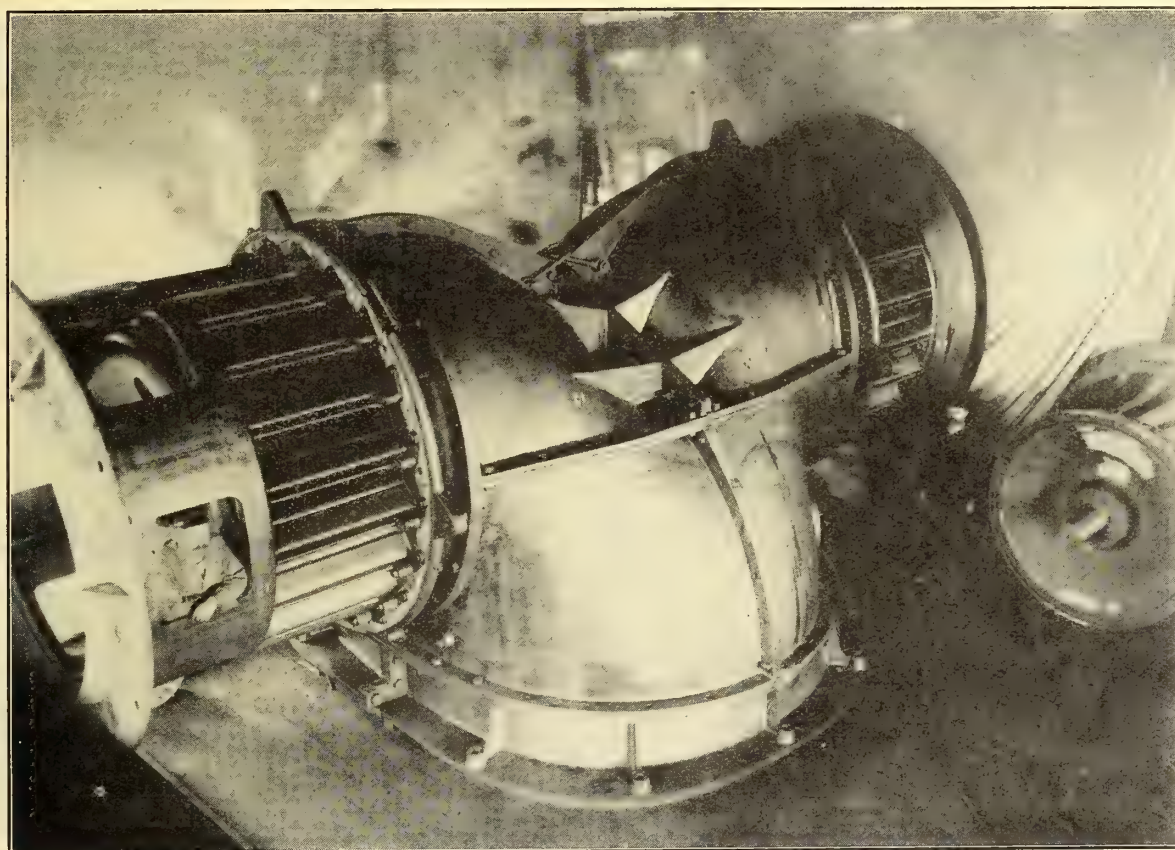
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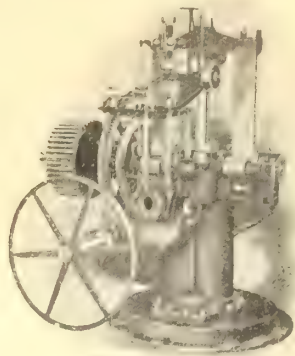
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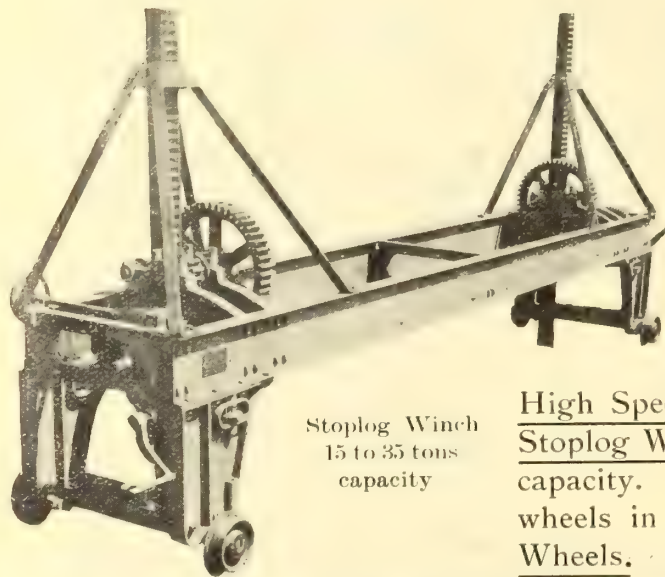
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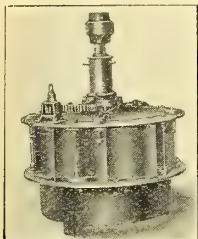
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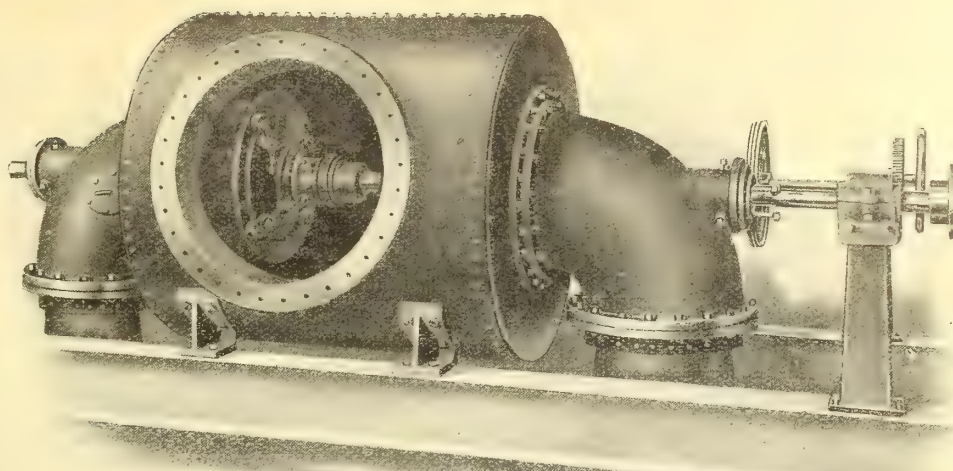
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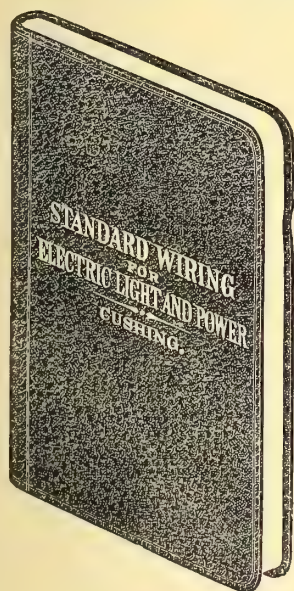
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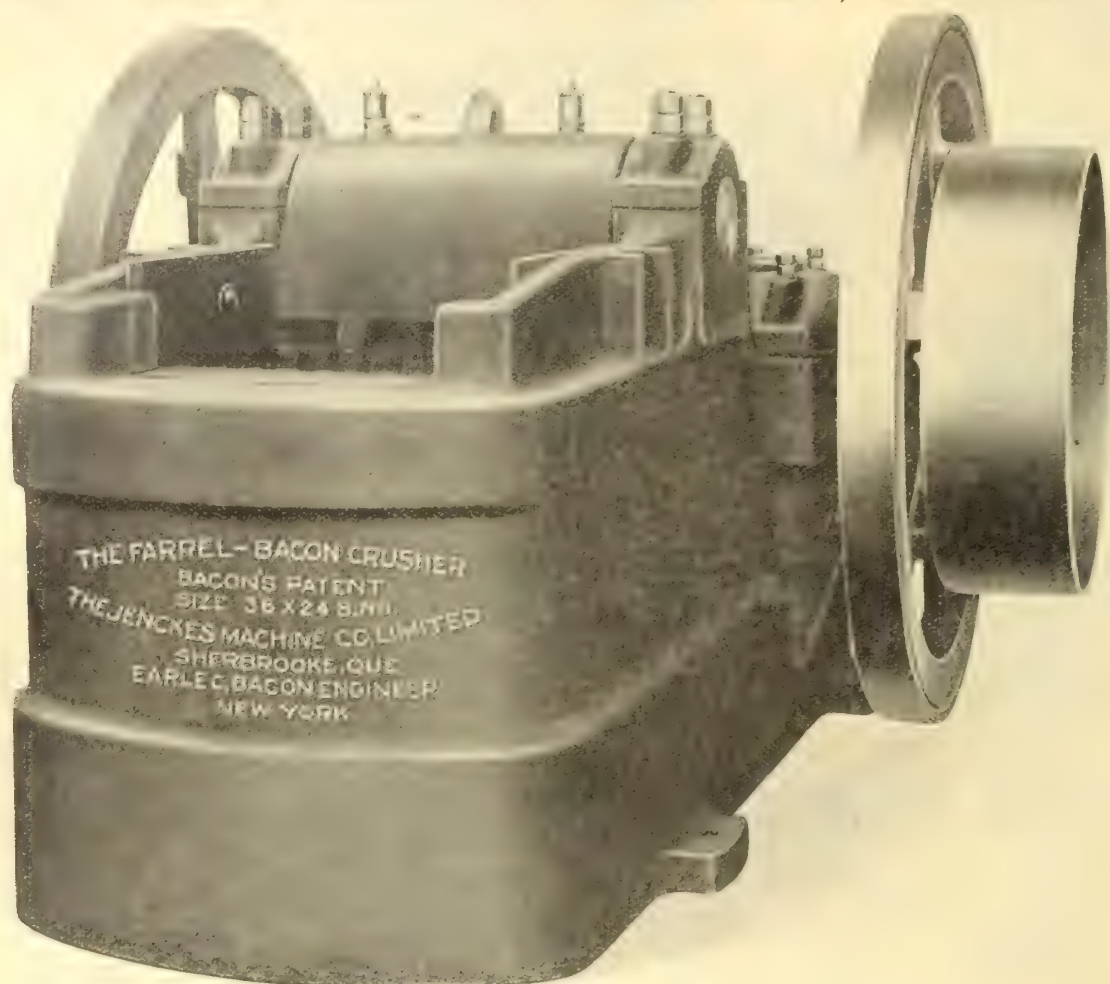
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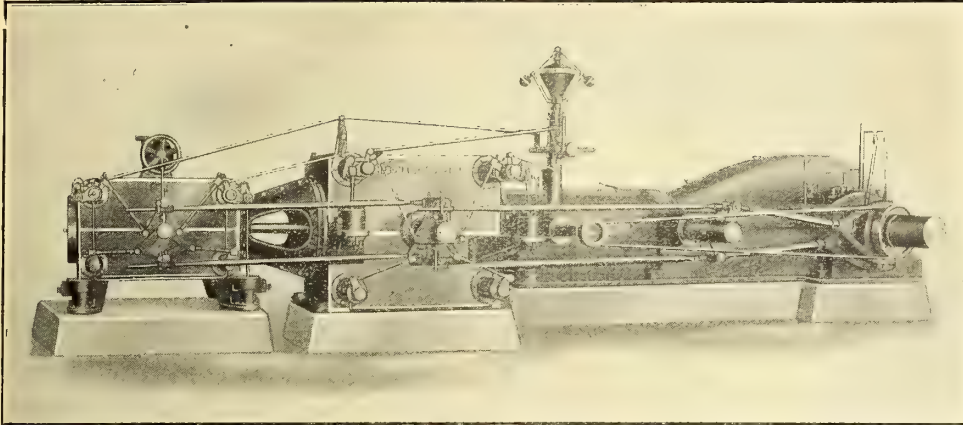
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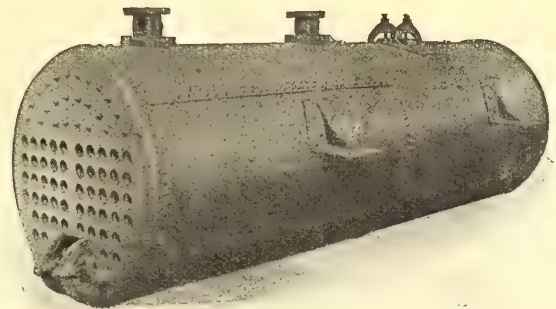
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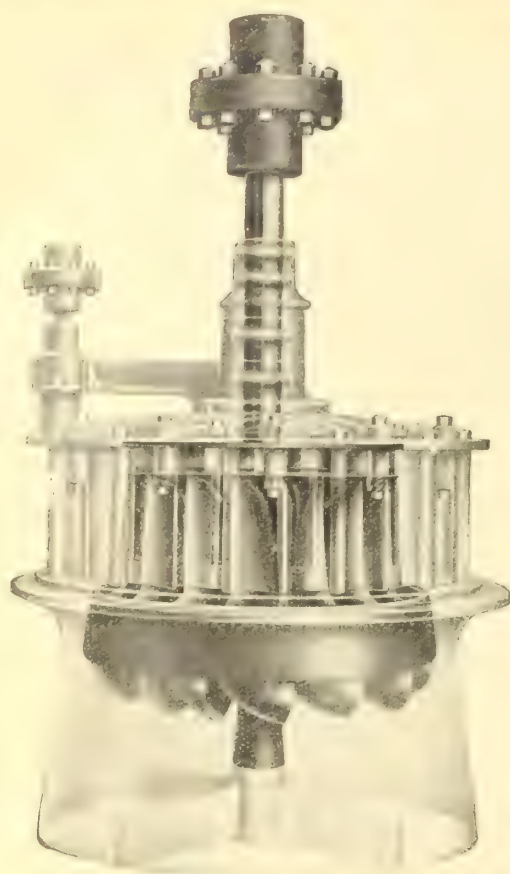
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And because no other wheel has yet shown such high efficiencies, the Samson is evidently THE wheel for you to use.

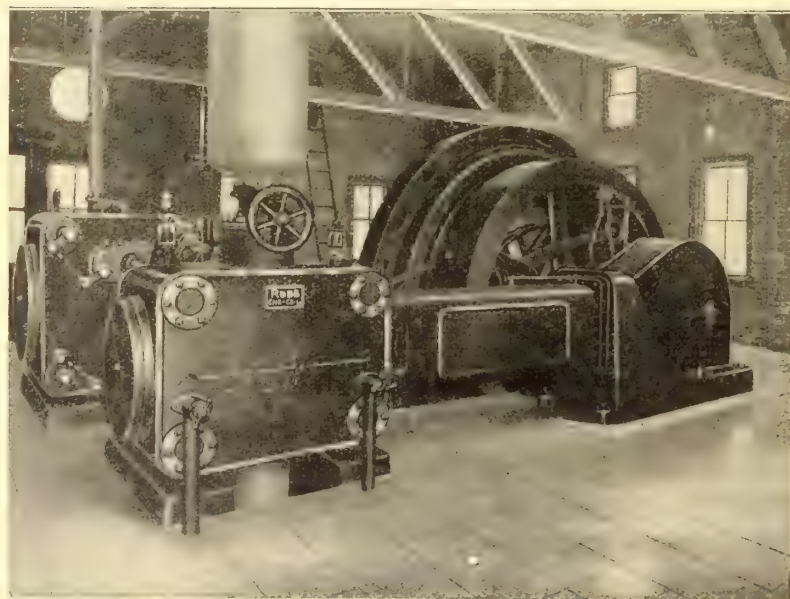
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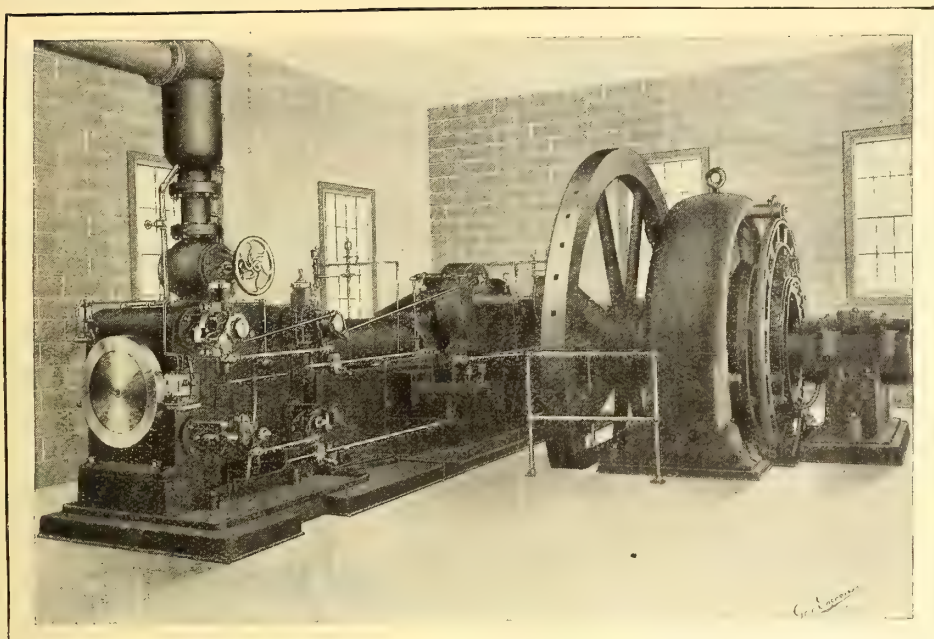


Illustration shows one of 3 Heavy Duty Goldie Corliss Steam Engines built and installed by us for the Sandwich, Windsor and Amherstburg St. Ry. at Windsor, Ont.

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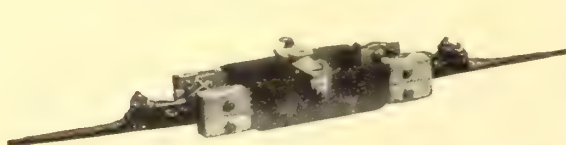
Designed with a liberal factor of safety which insures against failure under all adverse conditions it is necessary to provide against. The efficacy of the three devices illustrated is typical of the complete line.



The Westinghouse-Detroit Trolley Frog

Used on any turnout regardless of the degree of curvature. Bodies are malleable iron or bronze. Long, flexible, bronze approaches prevent the trolley wheel striking a blow, and avoid crystallization of the trolley wire.

Note the groove in the pan of the frog. This steadies the trolley wheel and prevents its accidentally taking the turnout when on the tangent at high speed. The pan is short, and the trolley wheel travels a minimum distance on its flanges.



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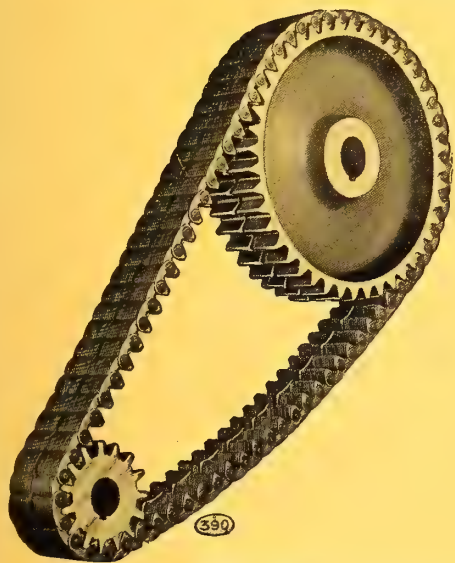
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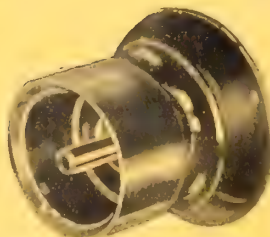
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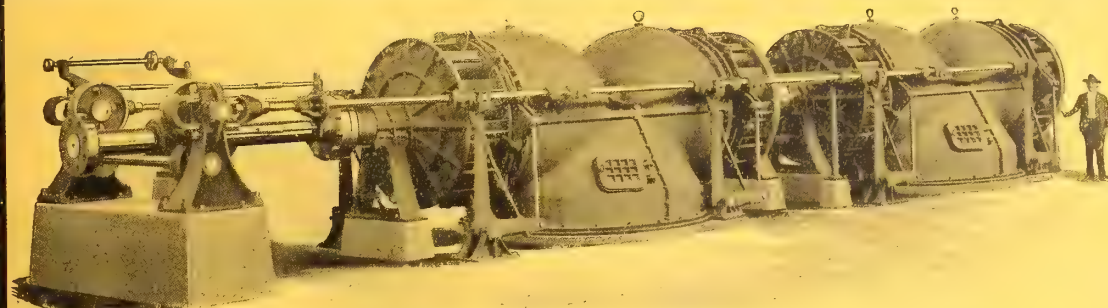
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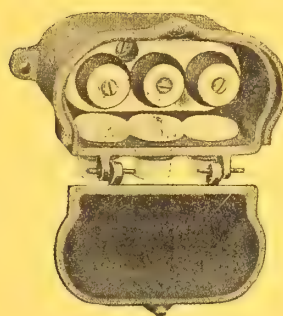
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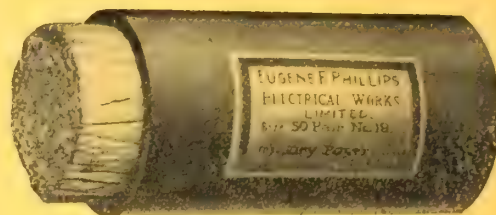
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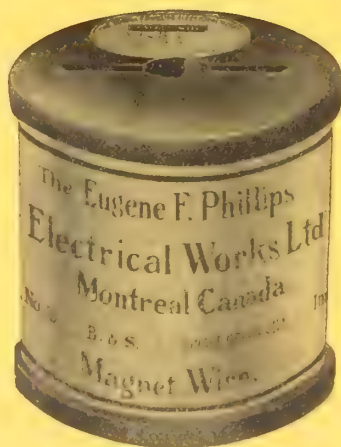
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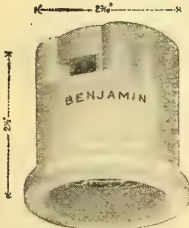
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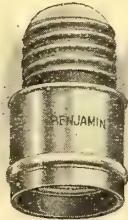
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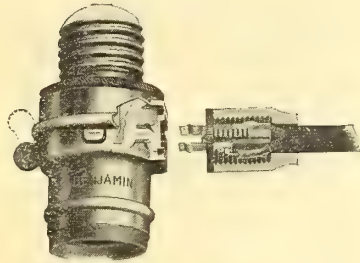
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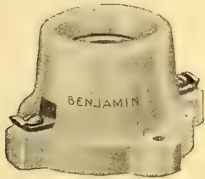
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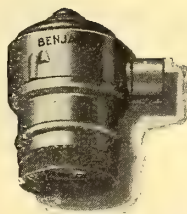
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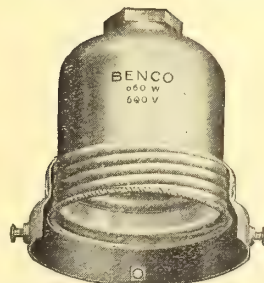
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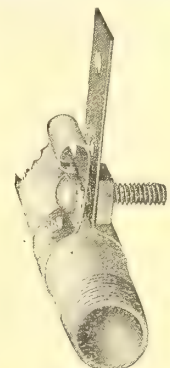
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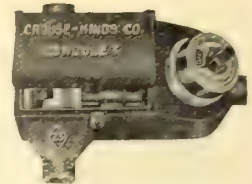
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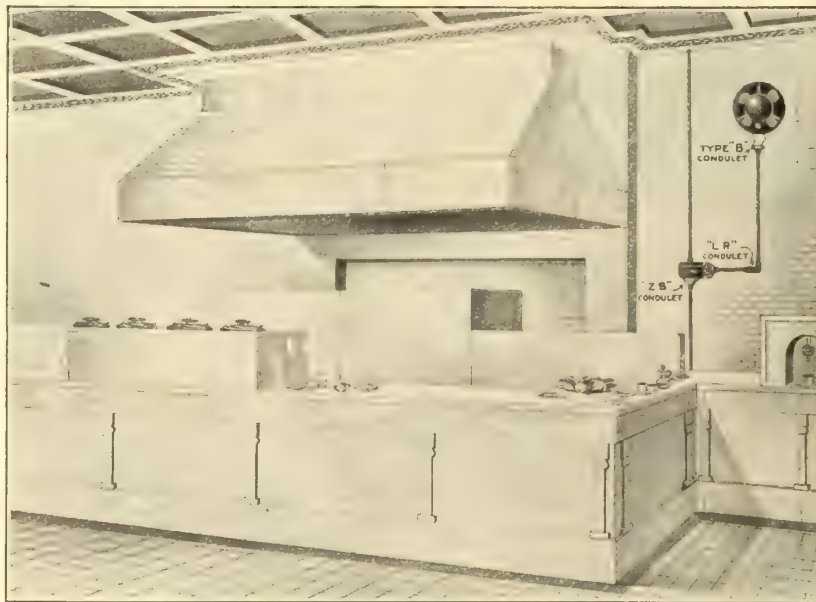
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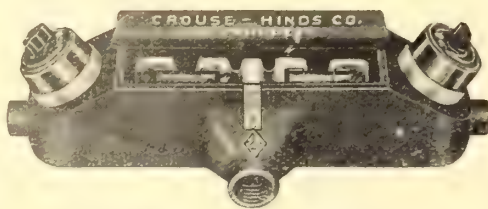


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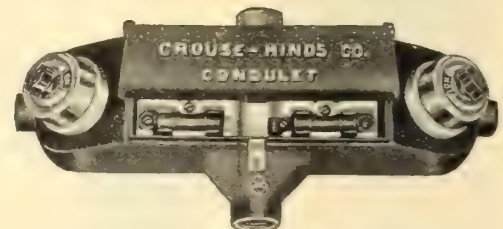


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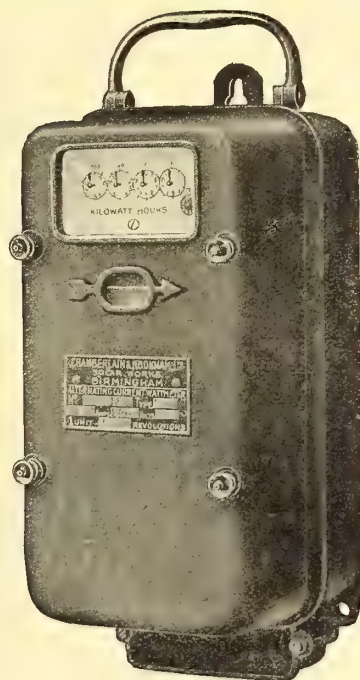
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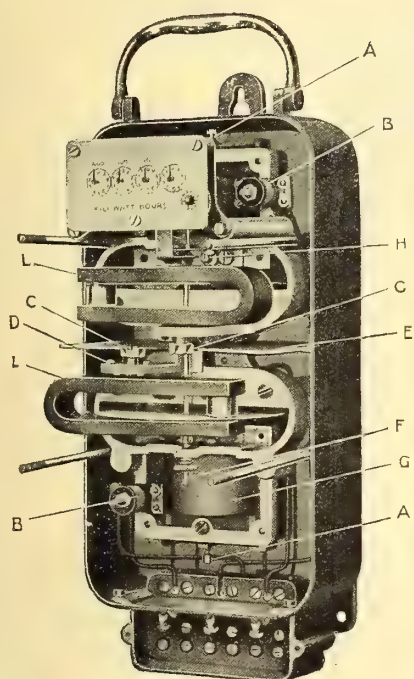
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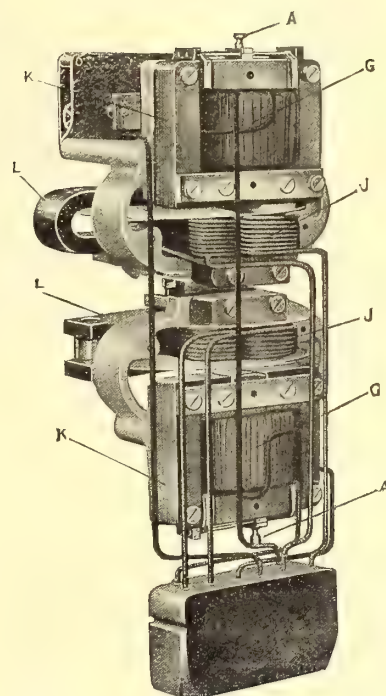
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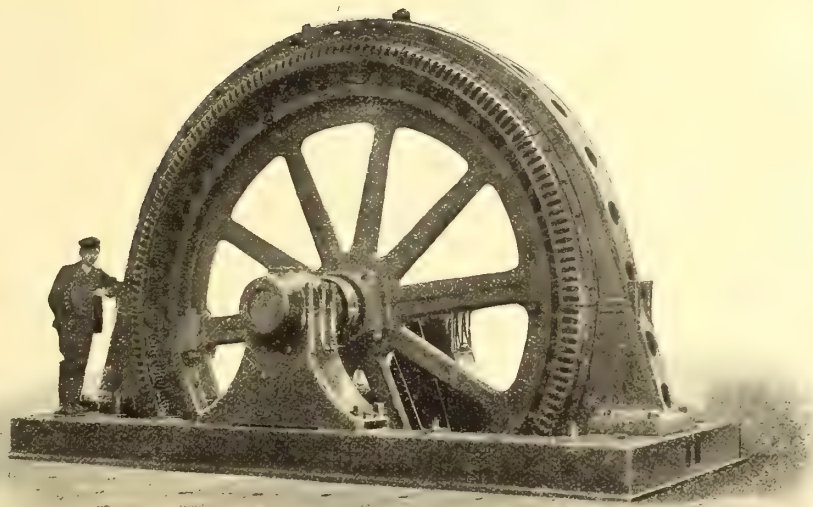
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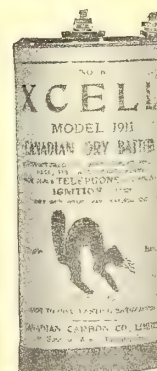


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We believe it is true that since artificial light was first used no single system has made such progress in anything like the same period of time as EYE-COMFORT SYSTEM OF INDIRECT ILLUMINATION.

Consider just what this means, carefully taking into account that this remarkable development has occurred during the *most critical* period in the history of the industry. Such progress can be accounted for by the simple fact that EYE-COMFORT SYSTEM OF ILLUMINATION GIVES PERFECT SATISFACTION TO THE CONSUMER! "Let them judge" is our motto.

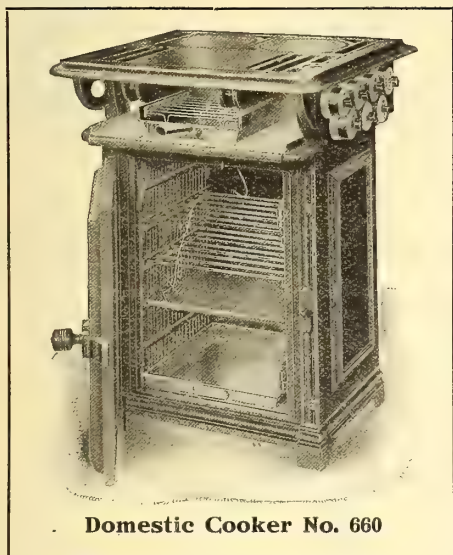
THE EYE-COMFORT SYSTEM has been tried out in practically every conceivable kind of installation—public halls, libraries, stores, offices, homes—and, where installed, it has proved its worth as more satisfactory from every point of view than the old time "direct" lighting methods where the harsh, irritating rays fall directly into the eyes.

For whatever purpose, you will find it worth your while to carefully investigate The EYE-COMFORT SYSTEM.

Let our Illuminating Engineering Department give you proper advice on this subject.

National X-Ray Reflector Co.

214 Jackson Boulevard, CHICAGO



Domestic Cooker No. 660

Guaranteed for
12 months

Eclipse Electrical Heating and Cooking Appliances

A complete range of appliances for all heating and cooking operations

Cookers, Domestic, Restaurant, etc.

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Toasters and Grillers
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VICKERS LIMITED, Lewis Building, 20-24 Bleury Street, **Montreal**

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desiring to finance their needs by the sale of Bonds are requested to communicate with us.

We deal extensively in the bonds of Hydro-Electric Power Companies, Electric Railways, Gas Companies and Electric Lighting Companies which meet our requirements.

E. H. Rollins & Sons

Investment Bonds

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Boston, Mass., U. S. A.

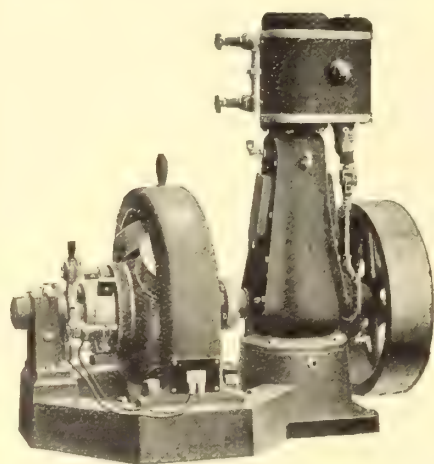
**We Purchase Outright
entire issues of bonds
on steam and elec-
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N.W. HARRIS & CO.

Established 1882
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35 Federal Street, Boston, U.S.A.

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By Efficiency in a Generator we mean one that will give you maximum output for the least expenditure of driving energy.

**Toronto & Hamilton
Electric Company**
Hamilton, Ontario

Electrical Supplies of Every Description

A few of our specialties :

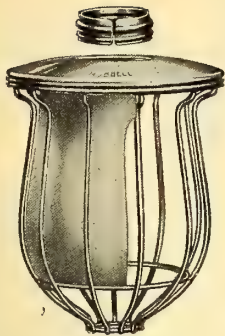
**Moloney High Efficiency Transformers
Carbon and Tungsten Lamps
Rigid and Flexible Conduit
Condulets**

Large stock ; prompt shipments.

Write for new and complete catalogue No. 3.

**Central Electric & School
Supply Co., Limited**

36 Adelaide St. West, Toronto



No. 5766

Lamp Protection and Light Reflection

This combination is of great value in factory service. It can be used to equal advantage on drop lights and fixtures. The Reflector can be turned so as to focus light on any manufacturing operation and the eyes are shielded from glare. The reflector is removable.

Hubbell Reflector Guard

It is held in place by spring projections which snap around the guard wires. This combination enables the use of small lamps in place of large ones thereby effecting a saving on current bills. Dealers write for discounts and free sample.

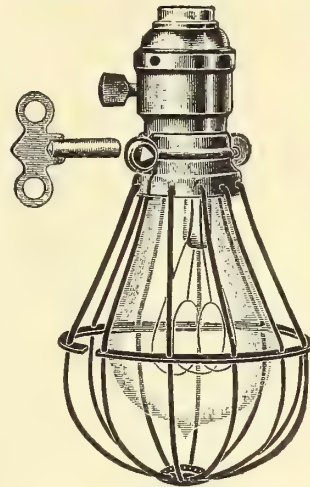
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Any incandescent Lamp Anywhere, in danger of Breakage or Theft may be safely and cheaply insured by the use of a



LOXON LAMP GUARD

THE KEY TO SAFETY

It locks on with a key and is the only guard protecting against all classes of lamp loss.

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because it gives great satisfaction.

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Largest Exclusive Electrical Supply House in Western Canada



We Cover NORTHERN ONTARIO, MANITOBA, SASKATCHEWAN and ALBERTA.

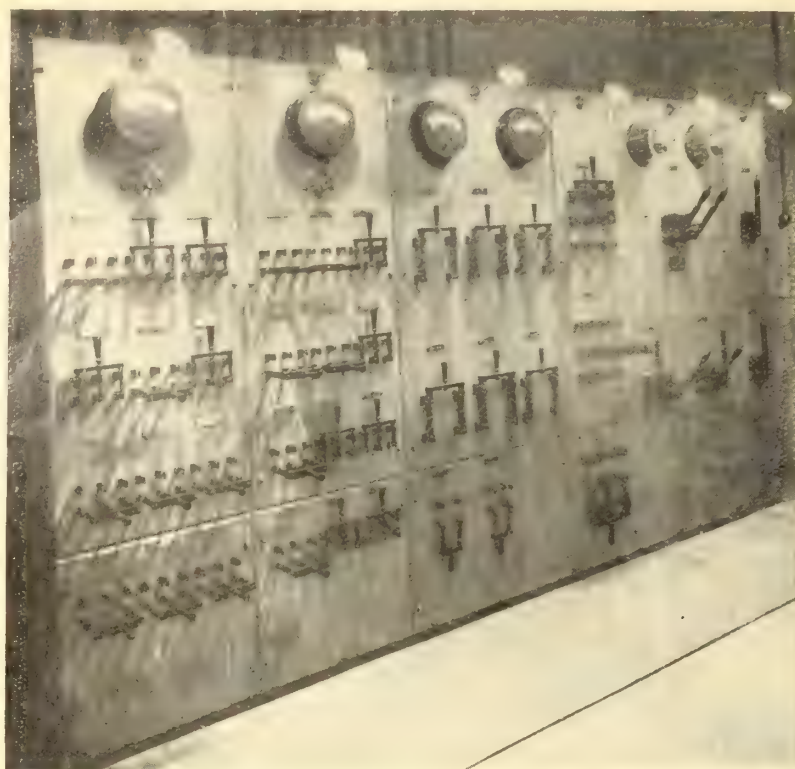
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Write for our new 1912 calendar.

The James Stuart Electric Co.

324 Smith St., Winnipeg, Man. Limited



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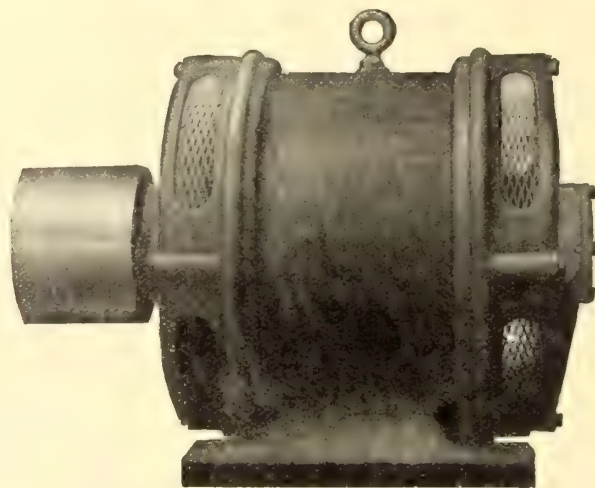
Are the make used in many of the largest institutions, office and government buildings in the United States and Canada.

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WHY?

because they are the recognised leaders.

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Standard Semi-Enclosed Squirrel Cage Induction Motor

The Phoenix Dynamo Manufacturing Co. Limited - Bradford, England

BRANCHES: London, Glasgow, Swansea, Birmingham, Newcastle, Australia, Russia, Japan, Canada.

The new series of two and three-phase induction motors embody all the latest improvements, and at the same time by a judicious disposal of the materials employed in their construction they are exceedingly compact, and the space occupied comparatively small. The materials and workmanship are the best of their respective kinds throughout, and the most important and minute details essential to the successful performance of the machines have received every consideration; every desirable feature having been embodied in their design and construction.

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Canadian Agents, The C. H. Keeler Co. Limited, Toronto, Ontario

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The quality of insulation used on hurried repairs is more important than in ordinary work, because the danger lies right there—in the hurry. If time is precious, material should be the best.

For those quick splices the best is
"A" SPLICING COMPOUND.

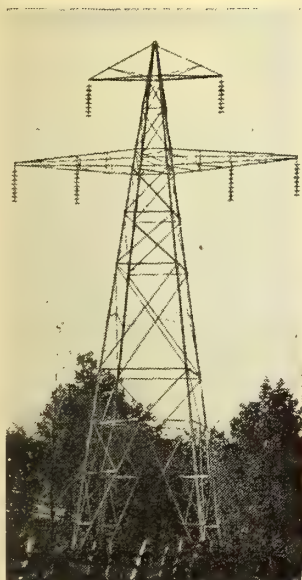
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MONTREAL CAN.

Liquid and Rubber Insulation

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Pioneers in Insulation Engineering

TRANSMISSION TOWERS



Hot Galvanized or Painted

Estimates furnished on
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Limited

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**STEEL RAILWAY AND
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Structural Steel of all kinds

DOUBLE CIRCUIT TOWER
One of 3,300 Towers furnished for the 300 mile Transmission Line of the Hydro Electric Power Commission of Ontario. Transmitting a 110,000 volt current from NIAGARA FALLS to the principal cities of ONTARIO. The largest single order of Transmission Towers ever placed.



No Power Proposition is too big for Gould Batteries

These Gould Storage Batteries are essential factors in permitting the Detroit Edison Company to profitably furnish to the Michigan Central R. R. power for the Detroit River Tunnel trains. This work involves variation from practically no load to 5500 kw. for from four to ten minute periods at irregular intervals throughout the whole day. It also demands the *utmost reliability and protection against delay of trains*. Only by the installation of Gould Batteries and special forms of Gould Regulating Apparatus could the railroad company be assured of a degree of reliability and close regulation of incoming power that would permit taking advantage of the Detroit Edison Company's service and entering into a mutually advantageous contract.

The Gould Batteries and Regulating System in this instance enabled the central station to furnish power on far more advantageous terms than possible by building and operating a private plant. Similarly, proper installation of Gould



Batteries offers opportunities for any central station in the furnishing of power for electric railways, electrified terminals, large shops and factories, rolling mills and other industrials with large power demands.

Our engineers are always ready with free advice on such subjects.

Gould Storage Battery Co.

General Offices: 341-347 Fifth Ave., NEW YORK

Works: DEPEW, N. Y.

BOSTON, 89 State St. CHICAGO, Rookery Bldg.

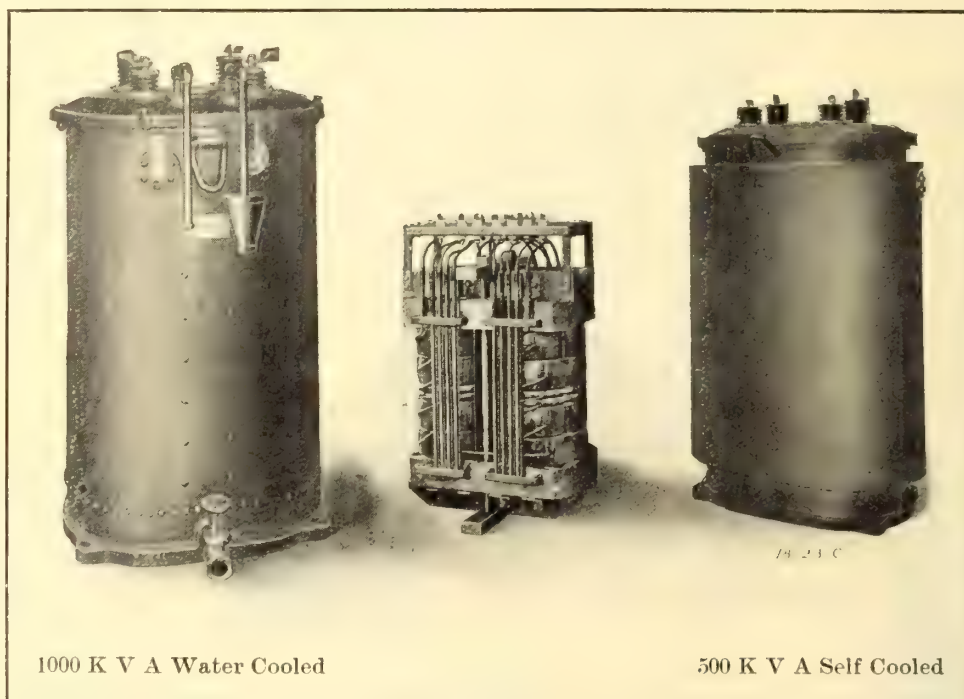
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Crocker - Wheeler **POWER** **TRANSFORMERS**

possess distinctive features which are of vital importance to users and which raise them above the level of all others.



1000 K V A Water Cooled

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We take pleasure in notifying our friends that we have acquired the

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I. P. FRINK
NEW YORK (Established 1857)

manufacturer of the famous "Frink" Reflectors, Reflecting Chandeliers and other lighting specialties.

The management and personnel of I. P. Frink will remain the same as heretofore, and the high grade of "Frink" Products will be fully maintained.

I. P. Frink will manufacture for us the well known J-M Linolite System of Illumination.

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This arrangement enables us to successfully handle any problem in illumination.

Let us hear from you as to your requirements.

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Manufacturers of Asbestos
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500 Amp. 6,000 Volt Automatic
Oil Circuit Breaker Laminated Con-
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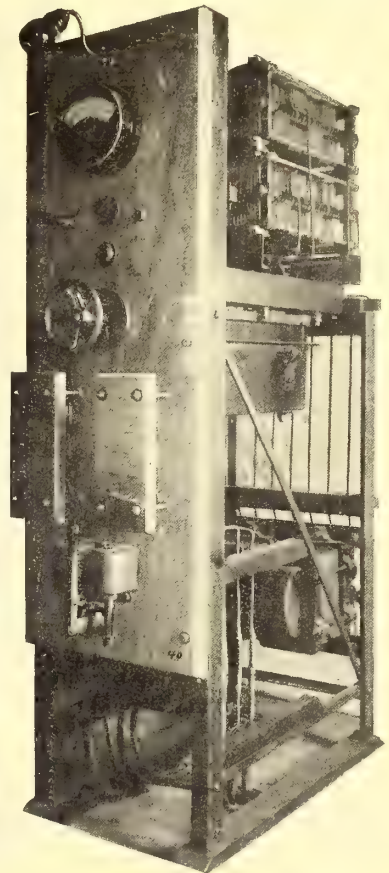
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**Electrical
Specialties,
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Special Transformers

and numerous other Electrical Ap-
pliances but space prohibits enlarging
on them in this issue.

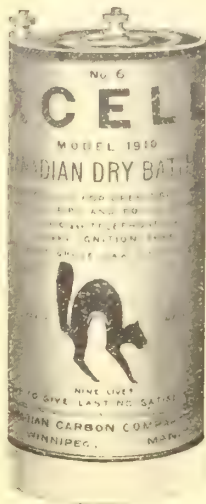
300 H.P. 2500 VOLT MOTOR STARTING EQUIPMENT



The Trade in the West

Naturally Prefers a

Western-Made Battery



X CELL DRY BATTERIES

Made in Winnipeg

suit the western consumer best, because he is sure of a FRESH full-of-vitality battery.

Our advertising campaign is "pulling" fine!

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Is a Guarantee of the highest perfection that modern facilities attain in the manufacture of LINEMEN'S tools.

Our Catalogue tells the story. **Get one.** It will help to solve the Spring construction riddle.

Oshkosh Mfg. Company

Successors to
Oshkosh Logging Tool Co.
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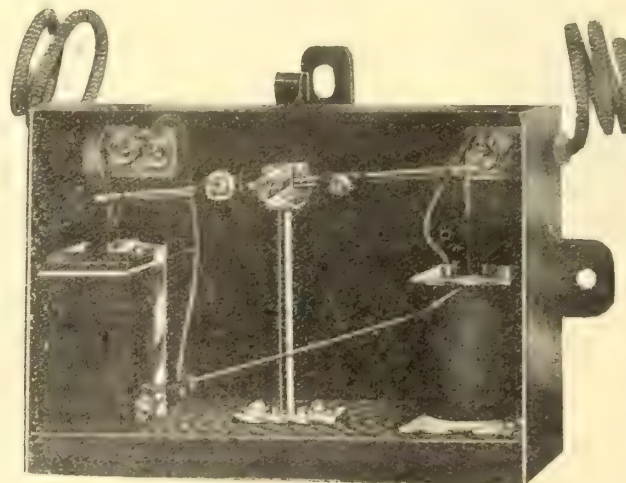
Oshkosh,
Wisconsin



Overload Does Not Injure This Controller

THE SHEDRICK ELECTRIC LIGHT CONTROLLER OR LIMITER

Not Made
to
Last a Year
But a
Lifetime.



A
New
Departure
in
Controllers

Result of test of a ten light controller put in circuit with an overload of four lights (fourteen in all) with an average make and break of one hundred and twenty per minute (330,000 strokes)—more than any instrument would be subjected to in a lifetime—showed absolutely no injury in any way to Controller.

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Electric Lighting Supplies

LAMPS, SOCKETS, ROSETTES, WIRES, CORDS,
CONDUIT, MOULDING, SWITCHES, CUT-
OUTS, FIXTURES, ETC., ETC.

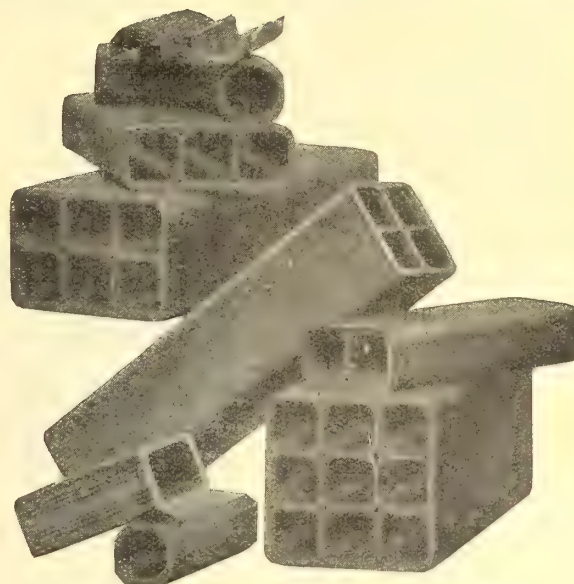
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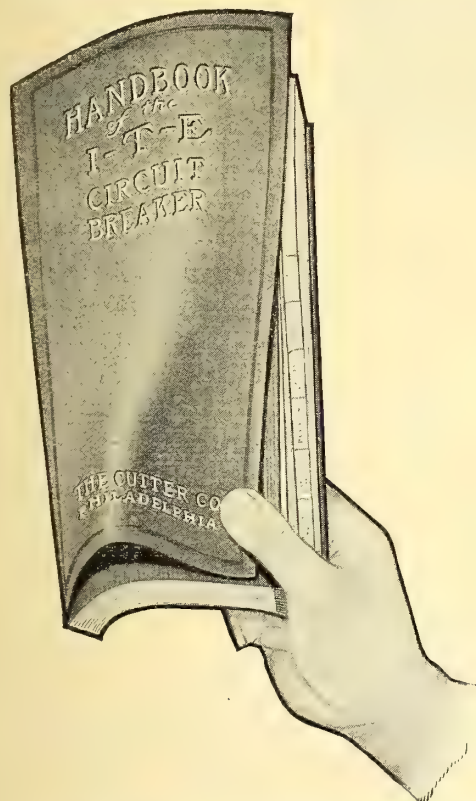
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AKRON, OHIO.

Vitrified Conduit—Best Made



Among our Satisfied Customers are Cities of
Toronto, London, Calgary.
Ask Them.



BY the time these lines reach your eye we will have ready for distribution a HANDBOOK of the I-T-E CIRCUIT BREAKER. This is a combined TEXTBOOK on the use of circuit breakers and a PRICE LIST of our product which should be in the library of every Consulting and Operating Engineer.

We have been at work on this publication for more than two years, and have spared no pains or expense to make this work so authoritative that it will occupy the same position as a textbook that the I-T-E CIRCUIT BREAKER does in the electrical installation, the last word on the subject of protection.

THE CUTTER COMPANY

MAIN OFFICE AND FACTORY :
PHILADELPHIA

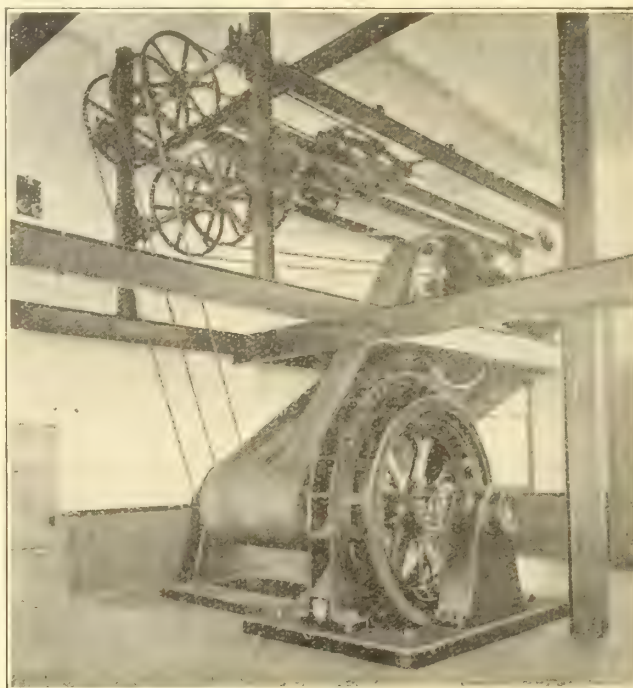
The Cutter Company, 120 Liberty Street, New York City.
The Cutter Company, 1122 Park Building, Pittsburgh, Pa.
The Cutter Company, 751 Ellicott Square, Buffalo, N.Y.
Eccles & Smith Co., 524 S. Los Angeles St., Los Angeles, Cal.
Electric Manufacturers' Sales Company, Denver, Colo.

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A Suggestion to the CENTRAL STATION

In the milling industry, central electric stations should find a profitable market for the sale of power. Most modern flour mills are laid out for electric drive and the older mills, driven by uneconomical steam plants, will find it advantageous

to substitute electric power. The most striking results are greater economy in production and less danger of fire, and, consequently, lower insurance rates.



**700 H. P. Motor, Maple Leaf Milling Co.
Port Colborne, Ont.**

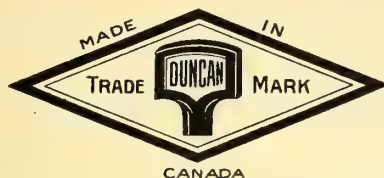
This mill is supplied with power from Decew Falls and is equipped with the following induction motors, 550 volts, 3-phase 66 $\frac{2}{3}$ cycles, "AN" meaning squirrel-cage and "F" wound-rotor motors.

Type	No.	H.P.	R.P.M.	Work	Type	No.	H.P.	R.P.M.	Work
F	1	700	500	Main Drive	AN	10	10	1333	Conveyors
F	1	300	500	Wheat Cleaning	AN	1	10	1870	2-in., 2 S. Turbine Pump
AN	1	75	666	Packing House					100 U. S. Gals. 132 feet
F	1	50	1000	Car Puller	AN	3	7 $\frac{1}{2}$	1333	Conveyors
AN	1	20	1000	Humphrey and Freight Elevator	AN	1	5	1333	Conveyors
AN	1	20	1333	Transfer Table	AN	1	1	1200	Volute Pump 10 Imp.
AN	1	15	1333	Transfer Table					Gals. 25 ft.

WORKS—MONTREAL

Sales Offices :—Montreal, Cobalt, Toronto, Winnipeg, Calgary, Vancouver

ALLIS-CHALMERS-BULLOCK LIMITED



A SUPERIOR SWITCH BASE THE "NEW CODE"

Here's a Switch Base which is especially designed for installing in proper position at the end of moulding terminal. It holds the switch in an **upright** position so that the tumbler works **up and down** instead of from side to side as in the old style switch bases.

The "NEW CODE" is well adapted for use in installing standard 5 and 10 Amp. Snap Switches. Notice the neat design,—away ahead of the old style, and the porcelain is of the very best grade we can procure.



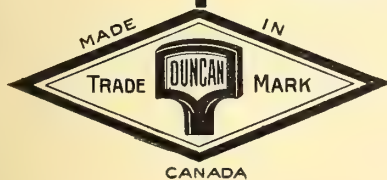
"New Code"
No. 2358

Immediate shipments from stock in cases of 200. Price six cents a base with liberal discount.

Write to us **NOW** while you're thinking about it.

The
Duncan Electrical Co.
Limited
Montreal

Makers of "Duncan Quality" electrical supplies bearing this diamond trade mark. Insist on the trade mark as it is your guarantee.



Now is the Time to Place Your Contracts for Fans



"Maestrale" for A. C. Induction Type

We have in Toronto a complete stock of the famous MARELLI FANS, and are well equipped to fill your orders for both A. C. or D. C. Fans.



"Borea" for A. C.

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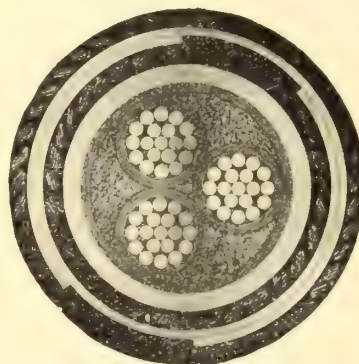
Wire, Flexible

Paper Insulated
Lead Covered
Cables

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MONTREAL AGENTS:

Alexander Macpherson & Son,
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.075 sq. in. three core, circular
lead covered, steel tape
armoured cable

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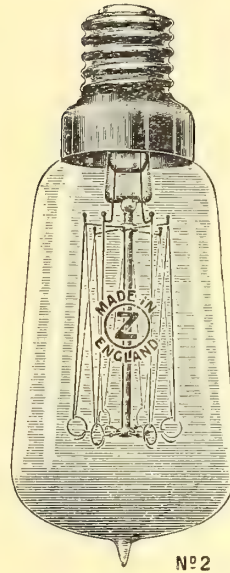
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Contracts taken for complete Cable Systems installed

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One of the greatest troubles with Tungsten Filament Lamps, a black deposit on the glass, has been successfully overcome in "**Z**" **Tungstens** by coating the stem of the lamps with **Phospham** which chemically absorbs the black deposit given off by the filament, thus keeping the bulb **as clear as a new lamp**. All "**Z**" lamps are fitted with **Standard Vitrite Insulate Bases**.

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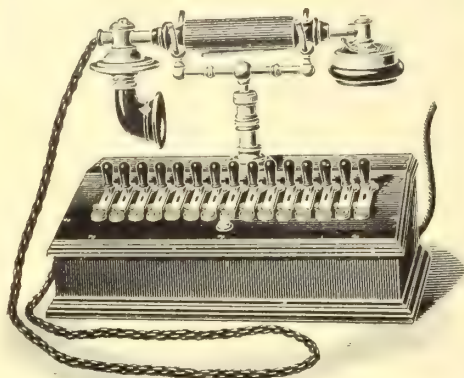
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Stock Carried in Montreal, Toronto, Winnipeg, Calgary and Vancouver

STERLING AUTOMATIC INTERPHONES



No. C 460

Primax Interphone System

See Local Batteries Dispensed With
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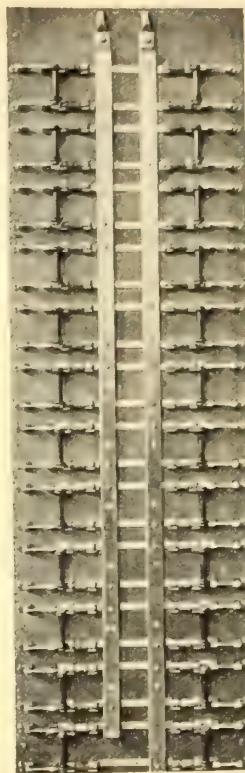
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J. Starr, Son & Co., Ltd.,
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**Devoe Panel**

Now is the time for
you to purchase the
material for distri-
buting current into
the building you are
wiring.

Devoe**Panelboards,
Cabinets and
Switches**

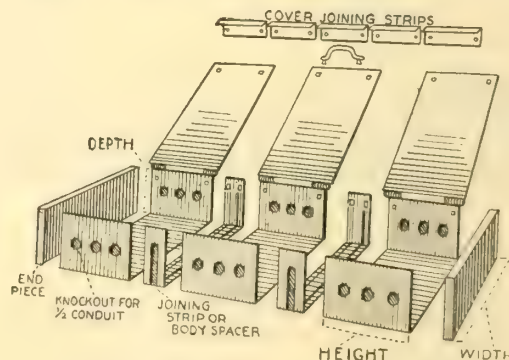
will meet every re-
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most particular pur-
chaser, send us your
next order and let us
prove it.

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OFFICE AND FACTORY

157 Craig St. West — — MONTREAL, QUE.

COLUMBIA BOXES



With this system of "Enny-Size" box it is unnecessary
to keep a large stock of various sized boxes. Just keep
a small supply of "Enny-Size" parts and make up your
different sizes as you require them.

Columbia Metal Box Co.

Northern Electric Manufacturing Co. Ltd.
Distributing Agents for Canada

These Trade-Marks Denote Established Standards of Quality

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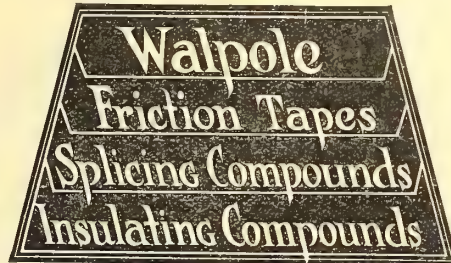
Oil Switches and Circuit
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T. & B.

Thomas & Betts Conduit
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Improved Blue
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Each Trade-
Mark is Your
Guarantee of
Quality and
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The Large As-
sorted Stocks
in Our Houses
Allow Imme-
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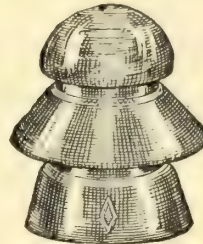
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THE WIRE & CABLE COMPANY



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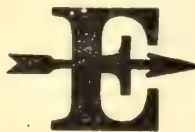


DRY BATTERIES

TRADE MARK
"Chloride Accumulator"

REGISTERED SEPTEMBER 11, 1894

STORAGE BATTERY



ARROW ELECTRIC SWITCHES



HUBBELL SPECIALTIES

"Exide"
 REGISTERED APRIL 2, 1901

VEHICLE BATTERY

QUALITY

Each Trade
 Mark is Your
 Guarantee of
 Quality and
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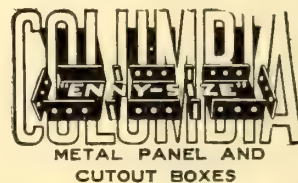
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LORICATED AND GALVADUCT CONDUIT



SKELETON AND ENCLOSED SIGNAL BELLS

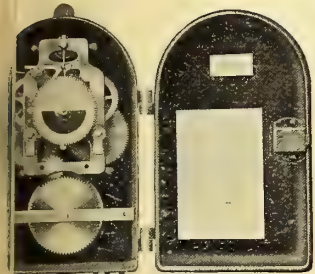


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 AND MANUFACTURERS

MONTREAL TORONTO WINNIPEG

ADDRESS

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DRY BATTERY

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The Large As-
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in Our Houses,
Allow Immed-
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of all Standard
Material

Inter-phones

MAZDA
LIGHTING FIXTURESHIGH AND LOW VOLTAGE
INSULATORS

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Electric

WIRING CO. LIMITED



WEST HOUSE

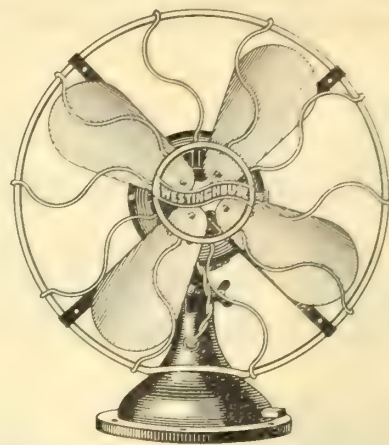
REGINA

CALGARY

VANCOUVER



BE PREPARED



The **Big Fan Rush** is almost here and discriminating buyers will demand the latest and best in electric fans. Right now is the time to get your orders in for

WESTINGHOUSE 1912 Model Steel-Frame Fans

The marked change in construction as offered by Westinghouse Steel-Frame 12-inch and 16-inch desk and bracket fan motors for alternating and direct-current circuits, represents unquestionably the greatest advance in fan motor construction.

The motor frame, the base and the guard arms are made of drawn steel, which combines great strength with minimum weight, the fans weighing from 20 to 90 per cent. less than fan motors of corresponding sizes.

The steel-frame fans are made in desk and bracket, oscillating and residence styles and the 8-inch fans are constructed of drawn sheet brass.

The desk and bracket fans are tilted or rotated in any direction and converted from desk to bracket and back again without the use of trunion adapter or tools. The loosening and tightening of a wing nut is all that is required.

WRITE TODAY FOR BULLETIN No. 2034

THE *Northern Electric*
AND MANUFACTURING CO. LIMITED

Manufacturers and Distributors of Telephone
Apparatus, Electrical Supplies, and Fire
Alarm Apparatus for every possible need.



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Toronto

Winnipeg

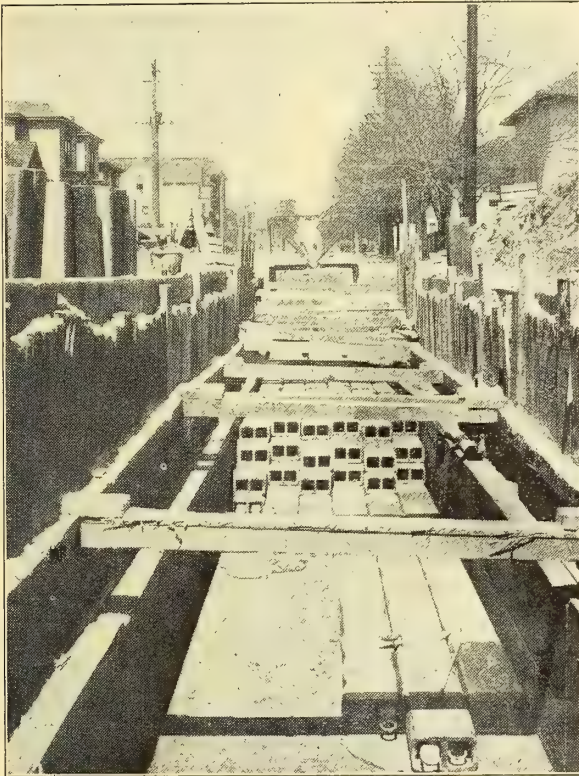
Regina

Calgary

Vancouver

G. M. GEST

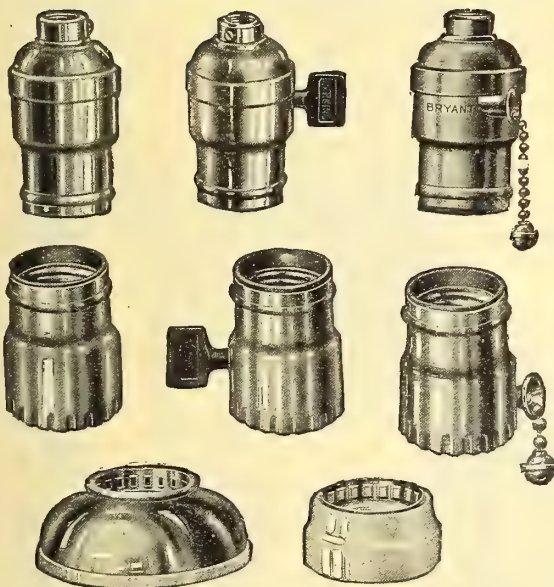
Conduit Engineer
and Contractor



Electrical Underground Conduit Systems

When **G. M. GEST** designs and constructs your Conduit System you receive the benefit of many years' experience and specializing in that line of work.

Power Building, Montreal, P.Q.



Get the "New Wrinkle" Idea

The Bryant and Perkins "New Wrinkle" idea has made it possible for Contractors and Dealers to obtain a large assortment of wiring devices from an exceptionally low investment. The pin-wheel card, copy of which we will be glad to send you upon request, gives a good idea of the numerous combinations which can be made up from a small stock of standard fittings.

The various bases and caps which make up the

"New Wrinkle" line are printed on the base card and the shells on the disk, which revolves. This permits each of the twenty shells to be brought against any one of the twenty six caps and bases, and when this is done, it shows the catalogue or style number of every one of the 520 complete articles which can be made up in this way. On the reserve side of the card, a complete index is shown, giving catalogue numbers, standard package quantities and list prices.

Write for Bulletin 2028 and ask for the Pin Wheel Card

THE *Northern Electric* AND MANUFACTURING CO. LIMITED

Manufacturers and Distributors of Telephone Apparatus, Electrical Supplies, and Fire Alarm Apparatus for every possible need.

MONTREAL TORONTO WINNIPEG REGINA CALGARY VANCOUVER



WRITE FOR OUR NEW PRICES.

THEY WILL SURPRISE YOU



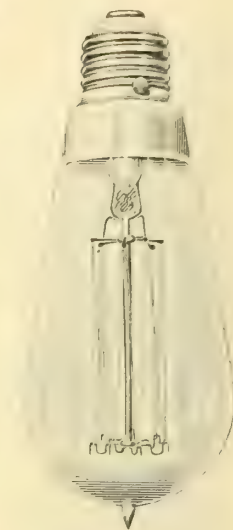
BERGMANN

Electrical Works, Berlin, Germany

**Metal Filament
AND
Carbon Filament
Incandescent Lamps
Best in the World**

PROMPT DELIVERIES

Direct from Stock in any Quantities



Look for the White
Porcelain Base

P. H. KLEIN Jr., CO.
329 Craig Street West - MONTREAL

Auto and Battery
Tungsten Lamps

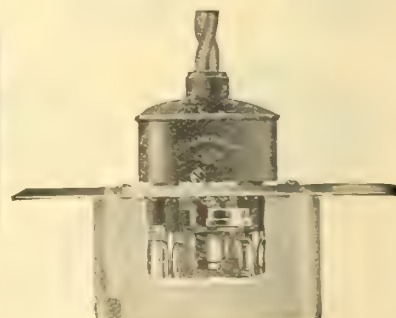
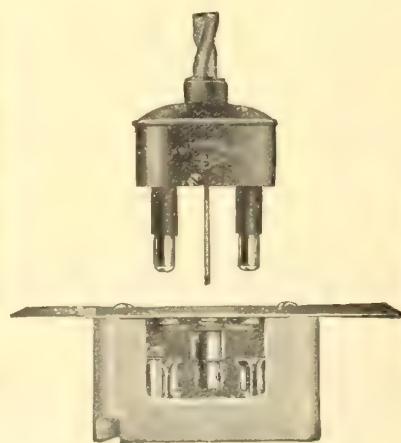
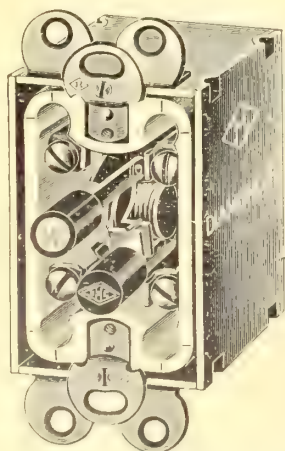
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Protect Your Investment in Switches by Specifying "Diamond H"

The best protection for the user because they are dependable in operation. The safest investment for the dealer, engineer or contractor because they give satisfaction.



The "Diamond H" on a switch is valuable insurance—assurance that quality, materials and competent workmanship are embodied to perfect production.

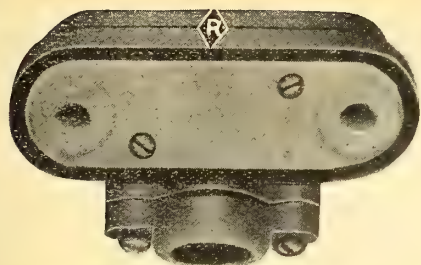


MANUFACTURED BY THE HART MANUFACTURING CO., HARTFORD, CONN.

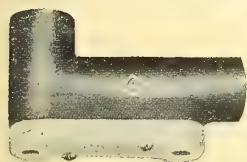
Canadian Sales Agent:

C. W. Bongard, Toronto, Canada

CONDUIT FITTINGS



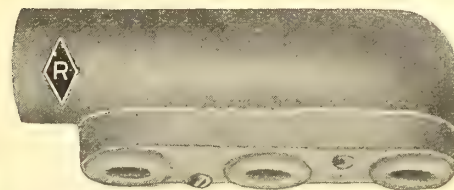
F 1/2"-2 Wire Cover



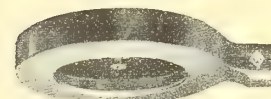
LB 1/2"-2 Wire Cover



A 1/2"-3 Wire Cover



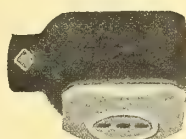
E 1/2"-3 Wire Cover



P 1/2"



1445 - Reversible Guard



K 1/2" Plug



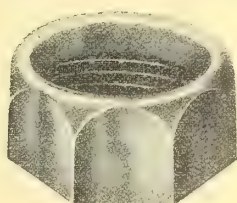
J 1/2" Receptacle



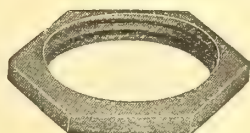
3/8" Fixture Stud



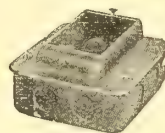
F D 1/2" Push Switch



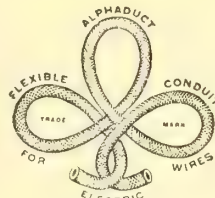
1/2" Bushing



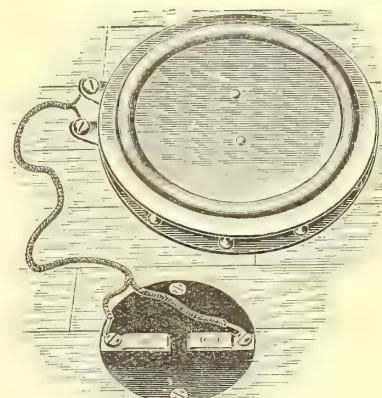
1/2" Locknut



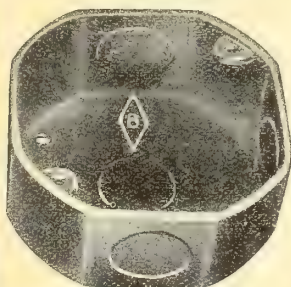
1915-Switch Box



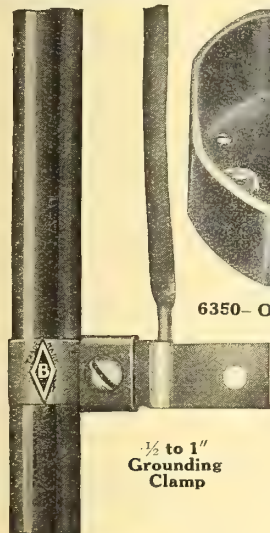
Alphaduct 1/4"



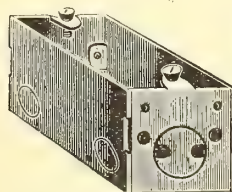
150-Floor Tread



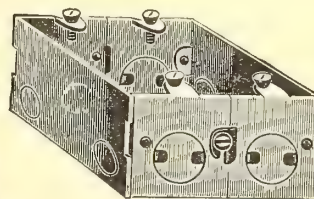
6350- Outlet or Junction Box



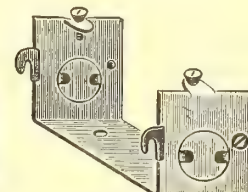
1/2 to 1" Grounding Clamp



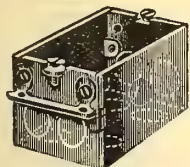
170-Comb Switch Box



172-2 Gang



171-Spacer



C C S. I. Switch Box

Electrical Fittings Co. Limited

70 King Street West, TORONTO, Canada

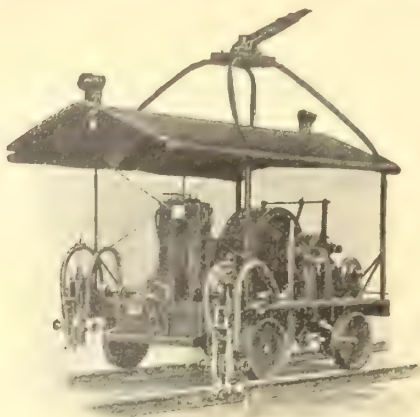
British Columbia Agents, Cope & Son Ltd., 132 Water St., Vancouver, B. C.

Quebec City Agents, Mechanics Supply Co., Ltd., 80-90 St. Paul St., Quebec, Que.

"Made in Canada"

Write for Catalogue No. 3. If your Jobber cannot supply, write us.

Electric Weld Rail Bonds



The conductivity of Bonds installed by our process can never be impaired by moisture or corrosion.

When once installed, they are on to stay and cannot be removed without actual mutilation and considerable hard work.

Write for Booklet

The

Electric Railway Improvement Co.

Office and Works, 6005 Carnegie Avenue
CLEVELAND

Insulated Clips

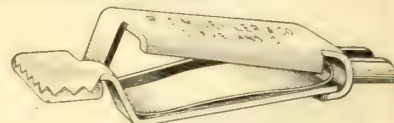
¶ The Universal Test Clip is now offered in an Insulated form as shown in the cut below. ¶ The Insulation in no way interferes with the action of the clip. ¶ The nose only is exposed and the raised collar over the shoulder acts as a finger stop.

A Time Saver in any electrical work requiring quick temporary connections.

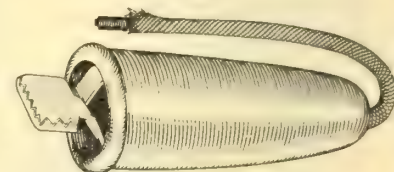
Used with magneto and microphone test sets, with voltmeters, and in general laboratory work.

Used on shop test benches, portable lamps and ignition cell charging outfits.

Used by lighting and power companies, telephone companies, wire manufacturers, railway signal inspectors and general electrical manufacturers.



No. 2



No. 3

Send to us for a **FREE SAMPLE** and then order of our

Exclusive Canadian Agents:

The Northern Electrical & Manufacturing Company

Montreal
Regina

Toronto
Calgary

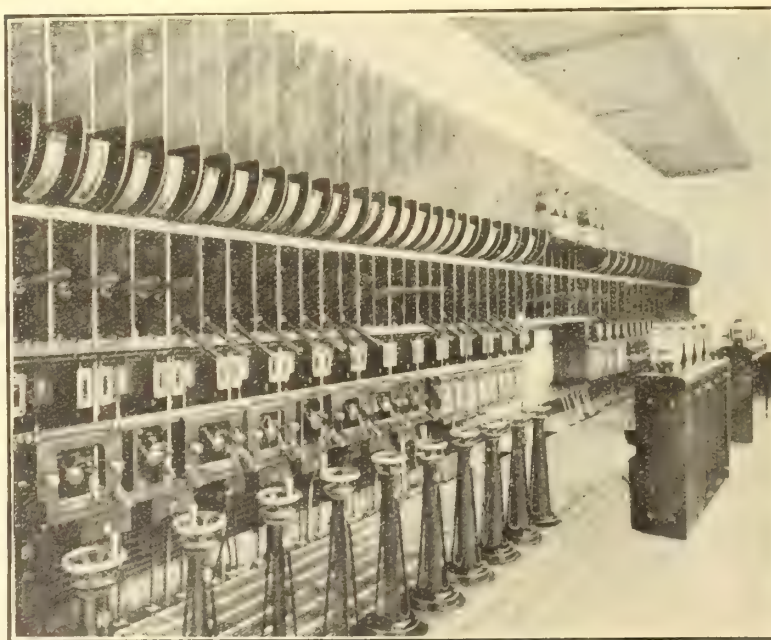
Winnipeg
Vancouver

**R. S. MUELLER & CO., 423 High Ave., S. E.
Cleveland, Ohio.**

FERRANTI LIMITED

**ELECTRICAL and
GENERAL ENGINEERS**

Manufacturers
of
Complete
Switchboards
D. C. & A. C. up
to 60,000 Volts.
Transformers
Auto Starters
Switches
Circuit
Breakers, etc.



Reliable
Operation
Substantial
Construction
combined with
Accuracy
and
High Class
Finish

Canadian Representative

G. C. ROYCE — West Toronto, Ontario.

If you are in the market for any kind of electrical equipment—send us your specifications and let us quote you.



SOME FRANK CHAPTERS

Insulator Testing

We have found that a large K. W. capacity back of insulator tests increases the voltage (measured by spark-gap) necessary to flashover the insulators and that a low K. W. capacity back of the test lowers the apparent voltage necessary.

Further find that a large K. W. capacity back of test works actual destruction so that if the porcelain be at all "off color" as to dielectric strength there will be sufficient current to "blow 'er up." Whereas with nominal K. W. back of test a weak insulator may only be manifest by small voltage drop and never found out.

We mean by nominal K. W. capacity, 30 to 50 K. W.; we mean by large K. W. capacity for test the "Victor" kind—500 to 600 K. W., one of the items that accounts for the permanency of transmission lines erected on "Victor" Insulators.

THE LOCKE INSULATOR MFG. CO., Victor, N.Y.

OR

Engineering Equipment & Supply Company

410 St. James Street,

MONTREAL, QUE.



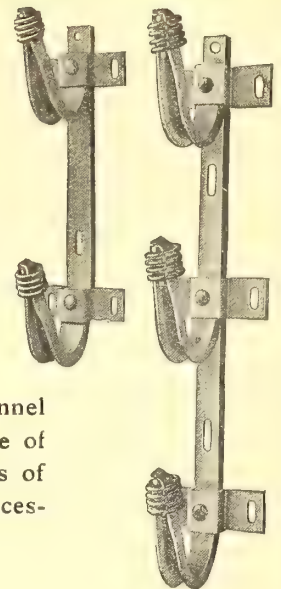
Peirce Brackets

These Service Wire Brackets are saving much in first cost and future up-keep for the Central Stations of the United States and Canada. Toronto and Winnipeg use them exclusively. Forty other Canadian Cities and over four hundred of the principal cities of the United States do likewise.

Peirce Brackets cost more in your warehouse but less on your patrons' buildings than other brackets. They are hot galvanized and made of hot rolled channel steel. The insulator springs are resilient spiral springs, which prevent the breakage of insulators. They allow for the inequalities of insulator bores. This resilient thread is of especial importance in Northern latitudes where wide ranges of temperature cause excessive expansion and contraction of cast iron brackets.

Our Catalogue Lists Sixty Different Styles

May we send you circulars showing why these brackets cost you less put up than unsightly cast iron brackets?



HUBBARD & CO.

PITTSBURGH, PA.

The World's largest manufacturers of Pole Line Hardware



Packard

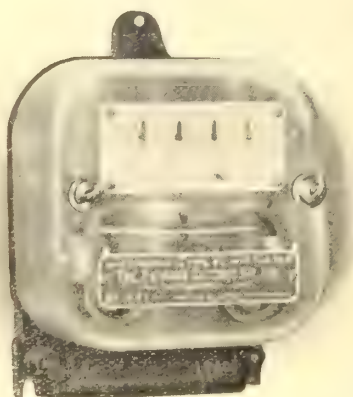
METERS

Absolutely Reliable

Type

"K"

Perfect Workmanship

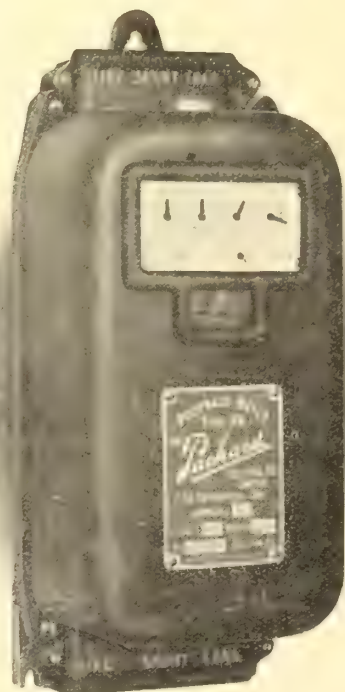


TYPE K GLASS CASE



TYPE K METAL CASE

Accurate
on
Light
Loads
—
Output
Increased



TYPE PK POLYPHASE

Guaranteed to Meet
the Most Exacting
Specifications
—
Prompt Shipments

YOU CAN ORDER PACKARD METERS FROM

St. John Railway Co., St. John, N. B.
General Supplies, Ltd., Calgary, Alta.

Complete stocks also at St. Catharines and
at our Warehouse at Winnipeg.

Write for New Full Descriptive Bulletin No. 120

The Packard Electric Company, Limited

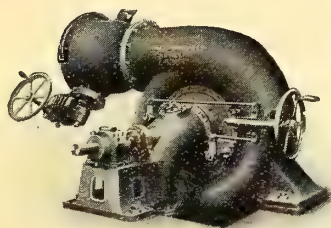
Factory: ST. CATHARINES

General Sales Office
901 and 902 Traders Bank Building,
Yonge and Colborne Sts., Toronto.

Phone M. 1002

N. W. Office and Warehouse
WINNIPEG

Water Power Plant



Type 30 Francis Turbine
1000 B.H.P. 120 Feet Fall

Pipe Lines, Governors, etc.

Apply to

James C. Gordon & Co.

81 and 83 Knightbridge Street
LONDON, - - ENGLAND

Messrs. Buyers in General,
ANYWHERE,
Canada.

Gentlemen:—

Are you aware that we stock sheet Fibre in sizes from .010 in to 1 in. and can fill your orders same day received for Fibres, Press-board, Leatheroid, Oiled Cambrics, Armature Tapes, Sterling Insulating Varnish, both Baking and Air Drying, besides, of course, a full line of Overhead Line Construction, Car Equipment, Building Wiring Supplies of all descriptions.

Your enquiries and orders entrusted to us will be subject to prompt and careful attention.

Yours to command,

Dawson & Co., Limited

148 McGill St., MONTREAL

P.S.—We strive to make each and every sale its own advertisement for further business. Does that appeal to you, SIR?

WESTERN BRANCH:

56 Albert Street - Winnipeg, Man.

Bakelite

Impregnated Wood

WOOD, particularly porous woods such as poplar, basswood and maple, can be so impregnated with the famous product BAKELITE as to be rendered hard and resistant to chemical and physical influence.

BAKELITE impregnated wood has an exceedingly high uniform dielectric strength, this being produced through the well known insulating properties of BAKELITE.

The importance of this for use on high-tension lines and throughout electrical work in general is great as the strength of wood, thus treated is increased and becomes an excellent insulator of electricity, withstands moisture, chemical, solvents and is rot-proof. Where such wood has to be imbedded in cement or other conditions under which it is liable to attack from dry-rot, the advantages of the bakelized product are plain.

Afterwards if desired a beautiful high finish can be obtained with Bakelite Varnish, which resists the same actions as already mentioned.

We will give full information upon request of the many valuable uses to which bakelized wood can be put in electrical work. Write us.

Plastics Limited
Van Horne Street, Toronto

DRAWN-WIRE

KOLLOID WOLFRAM

TUNGSTEN LAMPS

Reduction in Price !

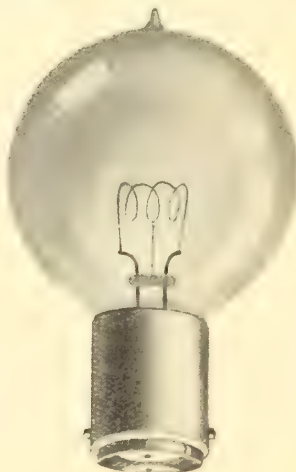
The immense increase in our Sales enables us to substantially reduce the price of most of our lines as promised a few months ago !!

K. W. Automobile Lamps

DRAWN-WIRE TUNGSTEN



Specially Toughened Filaments.
High Efficiency.



Exceptionally Close Price.
Long Life.



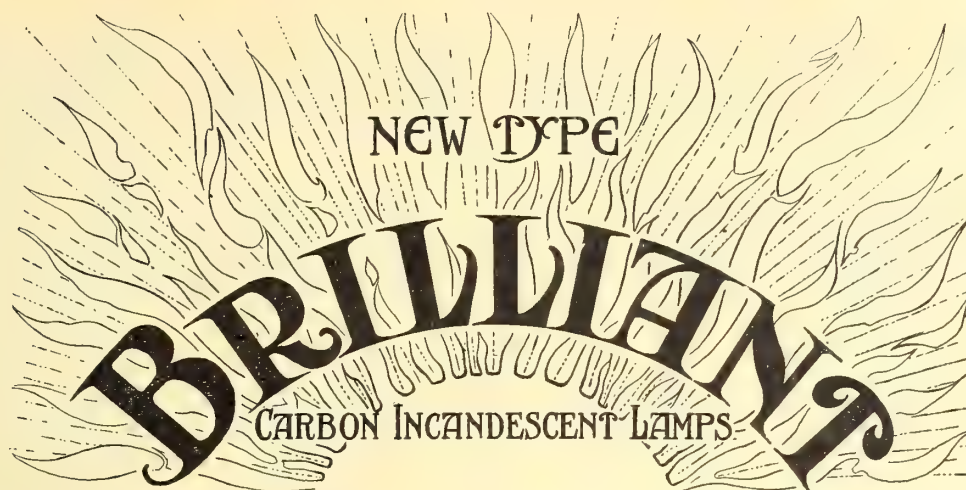
If Interested Ask for Descriptive Pamphlet at Once.

The Canadian Tungsten Lamp Company

LIGHTING EXPERTS

Limited

HAMILTON - - - ONTARIO



Made by Skilled Canadian Workpeople. Prompt Shipments. Close Specification.

Electric Glass Shades

Unique and Artistic
Designs

Immediate Deliveries
Very Close Prices



Tiffany, Venetian
Alabaster, Etched
Decorated and
Cheapest of Lines

BRANCHES: Montreal, P.Q.—30 St. Dizier St., J. W. Moneur, Mgr. Winnipeg, Man.—56 Albert St., A. L. Woolf, Mgr.
Toronto—342 Yonge St.

AGENCIES: New Brunswick—St. John, T. McArdy & Sons, Ltd. Newfoundland—St. Johns, WALTER CLOUSTON.
British Columbia—Vancouver, 606 Granville St. Victoria, B. C.—911 Government St.
Quebec, P. Q.—MECHANICS SUPPLY COMPANY, LTD.

The Canadian Tungsten Lamp Company

LIGHTING EXPERTS Limited
HAMILTON - - - ONTARIO

ELECTRICAL WIRES & CABLES

For All Purposes

Bare Copper and Aluminium Wires
and Cables.

Slowburning Weatherproof Wires; also
Weatherproof Slowburning Wires.

Office Wire, including Dampproof
Office Wire.

Weatherproof Insulated Copper, Iron
and Aluminium.

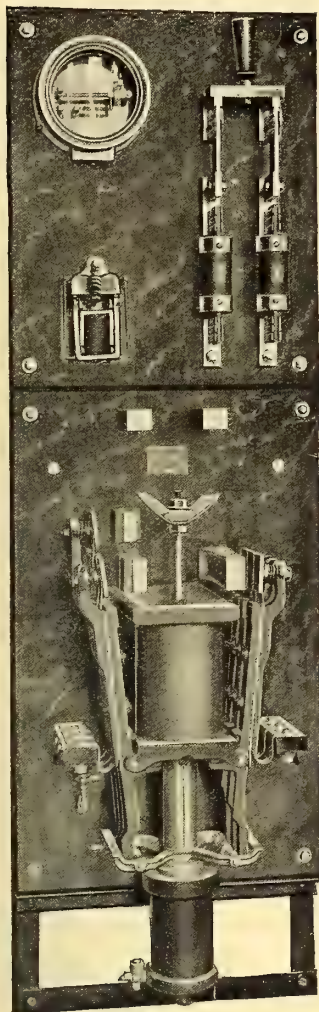
Rubber Covered Wires and Cables.

Galvanized Telegraph and Telephone
Wire.

Galvanized Steel Strand for Guys.

Canada Wire & Cable Co.

Factory and Head Office, 1170 Dundas Street, ^{Limited}
TORONTO - CANADA



SUNDH Panels Save Time, Space and Labor

Sundh Controlling Panels are Simple and Compact

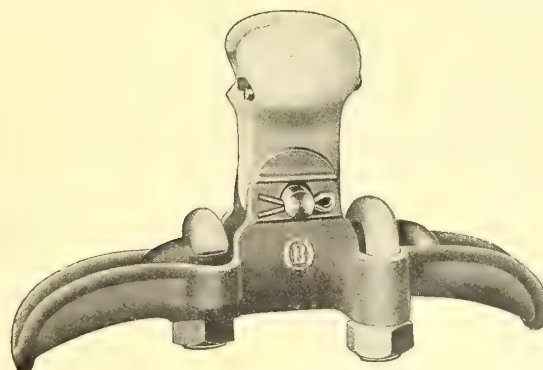
The illustration shows a Sundh 50 h.p. 220 Volt Controlling Panel, a combination of a Sundh Automatic Starter with main line switch and fuses and a Sundh Pressure Regulator.

Sundh Panels, Pressure Regulators and Switches are the simplest and most durable that expert engineering can produce. There are no sliding contacts to stick or get out of line.

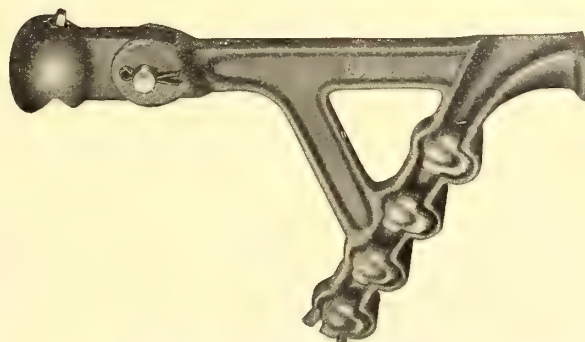
Send for our complete catalogue of A.C. and D.C. controlling devices.

Sundh Electric Co.
New York, U. S. A.

O-B Wire Clamps and Fittings for Suspension Insulators



Type B Clamp—No. 10879



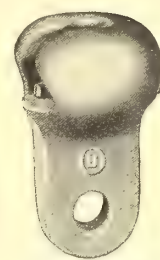
Type E Strain Clamp—Form 2



Ball Socket Clevis
No. 10758



Suspension Eye
No. 11106



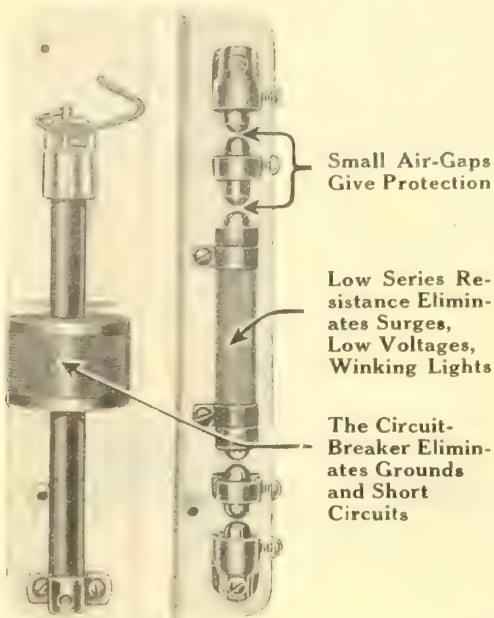
Ball Socket Eye
No. 10757

We can make prompt deliveries of a most complete line of efficient designs of this class of material.

Let us figure on your requirements.

The Ohio Brass Co.
MANSFIELD, OHIO, U.S.A.

Get All These In Your Lightning Arresters!



The illustration shows graphically just what you will get when you use Garton-Daniels Lightning Arresters—the only arresters giving you *all* these advantages.

In a lightning arrester, the thing you want to look for, for efficiency, is a small air gap. A small air gap means protection for your electrical apparatus.

You should also look for a low series resistance. In A. C. work, a low series resistance is the means of eliminating surges, low voltages, winking lights, and other similar troubles which would occur every time the arrester discharged if no series resistance were used.

A low series resistance accomplishes this purpose without impairing the efficiency of the arrester on which used.

But this is not all you should demand in a lightning arrester. You should get, in the same arresters, some *positive* means of cutting off the flow of line current following the lightning discharge to ground.

A mechanical circuit-breaker is the *most positive means known* for doing this, and the lightning arrester you buy having a mechanical circuit-breaker can't ground or short-circuit your lines by failing to cut off the flow of line current to ground.

There is one lightning arrester—and *only one*—combining the three features of a small air gap, a low series resistance, and a circuit-breaker—the

Garton-Daniels Lightning Arrester

From this arrester you get not only protection to your electrical apparatus, but you get freedom from grounds, short-circuits, surges and similar troubles on the line.

Can you afford to buy any lightning arrester *not* having these *three* features?

Garton-Daniels Lightning Arresters are carried in stock in Canada by John Millen & Son, Montreal, Toronto, Winnipeg and Vancouver. Prompt shipment can be made by them of all standard types.

ELECTRIC SERVICE SUPPLIES CO.

Railway Material and Electrical Supplies

PHILADELPHIA

NEW YORK

CHICAGO



GUARANTEED FOR 5 YEARS!

ALL CABLE END BELLS

CABLE TERMINALS

(WET TEST
2½ TIMES)

(74 Types)

CABLE POTHEADS

Equipped with Patent Ground Clamp Device. No expensive wiping of joints. Will eliminate all break downs and outages. Can ship from stock. Send for Catalogues. All bells shipped with filling compound. Bus bar supports for all voltages for round or flat bus. Malleable pins, wall tubes, roof bushings, air and floor boxes. Malleable switchboard and pipe frame fittings. NOTICE—We own Canadian Patents No. 126336 and No. 131114 covering all applications of cable bells or potheads.

ELECTRICAL ENGINEERS EQUIPMENT CO.

POWER HOUSE SPECIALISTS.

10-12 N. DES PLAINES STREET, CHICAGO, ILL.



Electrical News

Generation, Transmission and Application of Electricity

PUBLISHED MONTHLY BY

HUGH C. MACLEAN, LIMITED,

HUGH C. MacLEAN, Winnipeg, President.

THOMAS S. YOUNG, General Manager.

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Orders for advertising should reach the office of publication not later than the 20th day of the month preceding date of issue. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for \$1.00 per annum. United States and foreign, \$2.00. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Correspondence is invited upon all topics coming legitimately within the scope of this journal. Subscribers can materially assist by sending in news items and information regarding electrical development in all parts of Canada.

Vol. 21

Toronto, April, 1912

No. 4

Electricity and Excise

There is a department at Ottawa called the Inland Revenue Department. Its name implies its function—the imposition and collection of revenue taxes on commodities of home production or consumption. As such, it is concerned with the levy and collection of excise dues. This department is in charge of a capable deputy—an excise expert—and excise matters are intelligently and efficiently administered by him. The capital investment represented is somewhere in the neighborhood of \$50,000,000. But,—

The Electricity & Gas Inspection Acts are administered by this same department. The deputy is no expert, nor does he profess to be, in electrical matters. Worse still, perhaps, it follows that he can not be in sympathy with, or enthusiastic over, either the careful administration of the laws or their improvement. It is reasonable to suppose that if he did make recommendations or suggest changes these might not be in the best interests of the electrical industry of Canada. And yet, the capital involved in this industry approaches \$250,000,000,—five times as great as the other.

The explanation of this anomaly is simple enough. The revenue from the excise end of the department is large, that from the electricity and gas end is comparatively small. Therefore, electricity and gas matters have not concerned our governments. Electrical development is being hampered, standardization is delayed, inspection laws are carelessly administered, inefficient officers hold responsible positions, efficient officers are discouraged—all, apparently, for lack of a sympathetic, technical administrator. The mag-

nitude and importance of the electricity and gas interests justify and demand much greater consideration. Electrical men will be a unit on two points. (1) Electricity laws should neither be framed nor administered with any idea of revenue in mind. Electrical development is the corner stone of Canada's industrial supremacy and to hamper the former will delay the latter. (2) The administrator should be a man with intimate knowledge of the subject and with authority to act. Neither, without the other, can produce any results.

We believe this is a fit matter for active and aggressive tactics on the part of the Canadian Electrical Association and the Canadian Gas Association. In these associations we have a very large, influential and widely distributed membership whose combined efforts and influence can doubtless suggest and procure the necessary remedy. The logical sequence of steps would seem to be:—the removal of the administration of the electricity and gas acts from the control of the excise deputy-minister; the giving to the chief engineer of the Electrical Standards Laboratory full administrative authority with the status, if not the name, of a deputy-minister; and finally, co-operate in every possible way with the chief engineer, looking to improvements in the laws and their effective administration. There never will be a more opportune moment to act than now, when the new government is formulating its policy.

March Meeting Toronto Section A. I. E. E.

The paper delivered before the March meeting of the Toronto section of the A.I.E.E. consisted of a description of the generating equipment, transmission line and terminal sub-station of the Shawinigan Water & Power Company's new plant. This generating plant is situated on the St. Maurice River and has recently been extended by the addition of a new power house and three 16,000 kw. generators. Power is transmitted to Montreal by a 100,000 volt, aluminium, 16 strand cable carried on metal towers. The ultimate plans call for the installation of 5 such units which will bring the capacity of the new plant up to 80,000 h.p.

In the absence of Mr. Julian C. Smith, chief engineer of the company, who was expected to present this paper, Mr. Kaelif, chief assistant to Mr. Smith, was the speaker of the evening. A number of unique points were brought out in the paper. One of these is what may be described as the unit system of construction, having in view the isolation of each unit from the others as far as possible both at the generating and distributing ends. With this in view, each penstock is fed by a separate intake leading directly from the forebay, these different intakes being separated by stout reinforced concrete walls. Each separate intake is protected from ice and debris by a vertical curtain wall which when the plant is completed will extend 5 ft. under water. The opening connecting the intake with the forebay is divided into two parts each 13 ft. wide and so arranged that gates may be used to close them in case of emergency.

Another point of importance brought out was the gradual narrowing of the intake so that the water reaches the penstocks without any marked change in velocity at any one point. This plan had been followed with a view to avoiding the usual eddy currents set up under these circumstances and, the speaker stated, has been found to work out very satisfactorily.

Owing to the severe temperature conditions at Shawinigan Falls, special precautions have been taken to prevent the gathering of ice on the metal racks. The temperature of the gate house is kept up by warm air currents carried by ducts set in the cement work, which have their outlets near the metal racks, and so that the hot air can be

directed against the racks if necessary. Circulation of this air is kept up by means of an electric fan operating in connection with a 300 kw. electric heater.

The penstocks are 14 feet in diameter, which, though larger than normally considered necessary for the operation of a turbine of the size used, viz., 18,000 h.p., was found to reduce the friction losses and raise the effective head far more than enough to offset the additional expense. The turbines are double runner type and a feature in connection with their installation is a relief valve which opens automatically in case of trouble in the turbine and allows the water to discharge directly into the tail race. It was explained by the speaker that his company is at present building dams across the St. Maurice River so as to raise the water some 15 ft. higher in the intake canal. These dams are under construction at the present time.

Another interesting item brought out in the paper was the matter of synchronizing the old and new plant at the Montreal sub-station. It was pointed out that though these plants operate close together they are in actuality 175 miles apart since each transmits its energy to Montreal along its own line, one at 30 cycles and the other at 60 cycles. In Montreal the 30 cycle current is changed to 60 cycles and fed to a bus-bar in close proximity to that receiving the power from the new generating plant. The speaker stated that in the event of requiring to operate these two plants in parallel it required only two or three minutes to get them into synchronism and that practically no difficulty had been met in operating them in this way.

Isolated Plants

The question of installing a private plant in preference to buying electric energy from the central station is one which must be decided entirely on local conditions and requirements. It is a question that is being much discussed and strongly advocated by manufacturers of the smaller types of generating apparatus and on another page of this issue we present a very carefully worked out paper presenting the arguments as one of these manufacturers sees them. It is understood, of course, that one of the chief arguments in favor of a steam operated isolated plant is that the boilers must be installed in any case to take care of the heating, which means that the argument is applicable to any point in Canada, and presumably will carry greater force in proportion as the winter conditions increase in severity. On the other hand there is no question that it is necessary to have a more highly paid operator; there is the worry which every extra bit of apparatus entails, especially to an inexperienced owner, and there are the summer months, during which the boilers must be kept going when otherwise they could be idle. The article, however, will be of value in pointing out the chief arguments in favor of an isolated plant and might well form the basis on which conclusions could be reached when the question comes up as to whether or not an isolated plant shall be installed. It will also serve to indicate the approximate cost of installation and operation of such a plant in places where central station service is not available.

Cost of Street Light Installations

A treatise on the Mazda lighting system for streets has just been compiled and issued by the Sterling Electrical Manufacturing Company, of Warren, Ohio. This little treatise will be found valuable by any municipality which contemplates the installation of a street lighting system, for complete information is given covering the relative cost of the various departments of the work, from the digging of the post holes till the lights are turned on through-

out the complete system.

The information given refers specially to the street system of Warren, Ohio, but will apply, to a very great extent, to towns throughout Canada. Chestnut poles 35 ft. long, 6 in. in diameter at the top, are placed at from \$4 to \$5 each; cedar poles of the same dimensions at from \$7 to \$8 each; cedar poles 25 ft. long, \$1 to \$1.50 each. Digging holes for wooden poles, which holes are usually about 4 ft. deep, are placed at 30 cents each, though this is governed by the condition of the ground; raising, setting and tamping wooden poles, 50c. to \$1.25, depending on size. Cross-arms cost from 14c. to 29c. each, depending on size; cross-arm braces 4c. each; bolts, washers and lag screws are bought by the hundred at a few cents each. Glass petticoat insulators cost from 3c. to 4c. each. Wooden pins from 1c. to 2c. each; anchors for supporting poles 35c. each; span wire 5c. each; stringing wire \$12.50 a mile, which includes stringing three wires. The cost of assembling a pole 25c. The cost of weather-proof copper wire of all different sizes is placed at 14¼c. per lb., the number of feet per lb. for a triple braid weather-proof wire varying from 38 for a number 14 B. & S. gauge to 1.34 ft., for a No. 0000 size. Information is also given as to how a simple computation may be made of the size of wire required for carrying the desired voltages and amperes.

The total cost of installing one mile of wire from source of supply to distributing station in town by three-wire system, 2,200 volts, 10 per cent. drop, using 35-ft. poles, set 100 feet apart, using No. 6 weather-proof copper wire, is placed at \$657.70. Carrying three-quarters of a mile under the same conditions is placed at \$501.40; carrying one-half a mile \$330.60; carrying one-quarter of a mile, in this latter case allowing for only a 5 per cent. drop, \$168.30.

The cost of constructing one street light circuit over one mile of streets from a distributing station in the town, using 6.6 ampere lamps, 1,100 volt series arrangement, 10 per cent. drop, 25 foot poles, set 150 feet apart, other conditions as above, is calculated to cost \$215.11. This, of course, does not include lamps, shades, arms, and so on. In all the above cases the cost of stringing the wire is included. This circuit will accommodate a load of from 6 to 7 kw., or from 60 to 70-80 c.p. Mazda street lamps, or from 80 to 90-60 c.p. lamps, or from 120 to 130-40 c.p. lamps, or an assortment of the above lamps up to the kilowatt capacity and voltage of the line. It is understood that the lamps must all have the same ampere requirement, regardless of their voltage, to work satisfactorily in series.

Prices are also given on the cost of standards of various kinds and capacity, on the cost of raising, setting and assembling these, on the cost of cable, laying the same, and so on. The cost of a complete installation of ornamental standards on one mile of streets spaced 50 feet apart, is placed at \$8,932 for one-light standards, complete with 16-in. diameter Alba globes, assembled wire and set in cement. For three-light standards the calculated price is \$9,799; for five-light standards \$10,719. Where the standards are spaced 100 feet apart these figures are reduced to \$7,106, \$7,539, and \$7,999. This includes the cutting away of the sidewalks and road pavements and placing fibre conduit in cement.

Where sidewalks are not to be cut away for post-holes or pavements to be removed to lay cables and where cable is used without fibre conduit or cement, such an installation would be constructed in bare soil between sidewalk and curb. In this case the cost is much reduced, and placing the standards 100 feet apart the figures now are, for the one-light, \$3,911 per mile; two-light, \$4,345 per mile; five-light, \$4,805 per mile. The standards in the above calculation are all cast-iron.

A sample layout of a street lighting installation is

shown and diagrams are given of a single arrangement, a staggered arrangement on a narrow street, and an opposite arrangement. Valuable data is given on the correct mounting heights and spacings for streets for various widths. To any municipality intending to install a street lighting system this little book will be found of very great value.

Resuscitation from Electric Shock

The first meeting of the Commission on Resuscitation from Electric Shock was held in the board room of the National Electric Light Association, New York, on Feb. 22. This commission was organized upon the initiative of the National Electric Light Association, and has for a purpose the study of electric shock and the preparation of a set of rules for first aid in case of electrical accident. The commission is composed of members of the American Medical Association, National Electric Light Association and American Institute of Electrical Engineers, as follows:

Nominated by the American Medical Association: Dr. W. B. Cannon, professor of physiology, Harvard University, chairman; Dr. George W. Crile, professor of surgery, Western Reserve University; Dr. Yandell Henderson, professor of physiology, Yale University; Dr. S. J. Meltzer, Rockefeller Institute for Medical Research, New York; Dr. E. A. Spitzka, professor of general anatomy, Jefferson Medical College; Mr. W. D. Weaver, editor Electrical World, secretary. Nominated by National Electric Light Association: Mr. W. C. L. Eglin, electrical engineer Philadelphia Electric Company. Nominated by American Institute of Electrical Engineers: Dr. Elihu Thompson, electrician, General Electric Company; Dr. A. E. Kennelly, professor of electrical engineering, Harvard University.

At the meeting in New York City the medical members of the commission unanimously advocated the Schaefer, or prone, method as the best means in the hands of laymen for maintaining respiration in victims of electric shock, and the commission formally voted to recommend this method. A chart is now being prepared which will give details of first aid in cases of electric accidents and will describe fully the method of applying artificial respiration. This chart will be issued under the auspices of the National Electric Light Association.

The Ontario Municipal Electric Association

At a meeting of the representatives of the municipalities which are customers of the Ontario Hydro-electric Power Commission it was decided to form an association under the name the Ontario Municipal Electric Association. The objects of the association are stated to be, (a) to take united action on all hydro-electric matters; (b) to unite together, as far as practicable, in the purchase of electric supplies and to endeavor to obtain as far as possible a standardization of equipments, accounts, operation, and general management of municipal plants; (c) to work in conjunction with the Hydro-electric Power Commission of Ontario in promoting electrical development in the province; (d) to suggest such legislation as may be deemed of advantage to the hydro-electric undertakings of the province, and to take united action thereupon; (e) generally to promote the interests of the municipal electrical undertakings of the province.

Resolutions were adopted as follows. To a considerable extent these resolutions are incorporated in the Beck bill:—

1. That the Hydro-electric Power Commission be requested to prepare standard specifications for street lighting and other electrical supplies in all respects possible, after consultation with the municipalities.

2. That the Hydro-electric Power Commission be requested to obtain at the commencement of each year a list of the requirements of each municipality and to procure for and submit to the municipalities a price for the same.

3. "That the Hydro-electric Power Commission be requested to prepare a standard basis of rates to be charged by all municipalities, after first considering municipalities' representations."

14,000 H. P. in Contracts

Contracts for over 14,000 horse power have been signed by the Western Canada Power Company, Vancouver. Of this at least 13,000 horse power will be used as connected load this year. In addition to this a number of other contracts aggregating 3500 horse power will be signed as soon as the electrical connections can be made. On the above basis the company calculate it is quite probable that by July 1 the total amount of contracts signed up will be in excess of 20,000 horse power, so that by the end of the present year the estimated load of 30,000 horse power will be secured. In the annual report, issued on March 13, it is stated that the works are capable of being extended to four times their present capacity at a minimum cost, and will serve districts which are rapidly increasing in population. The balance sheet shows assets as follows: Cost of property franchises, etc., \$6,770,511; materials and supplies, \$75,171; accounts receivable, \$11,719; balance due on account of bonds underwritten, \$649,671; cash on hand, \$1,102, a total of \$7,508,176. Liabilities include accounts payable, \$296,864; bank overdrafts, \$211,198; bonds issued, \$3,999,613; stock issue, \$3,000,000.

Brampton will Install Motor-driven Pumps

The town of Brampton recently bought out the John McMurchy lighting system of that town which up to the present time has been operating in competition with the municipal plant. The purchase price was \$15,000. The Brampton Waterworks Commission now proposes to use electric energy in connection with the operation of their pumping station, and equipment will be installed during the coming summer. The installation will consist of an air-lift system to lift the water in the wells which vary from 100 to 120 feet in depth; direct-connected motors and pumps will be used to elevate the water into a large reservoir. W. M. Treadgold, town engineer, is in charge of the work.

The Nipissing Power Company

A four mile extension has recently been made to the 22,000 volt line of The Nipissing Power Company in order to deliver power in Powassan. A small galvanized iron sub-station has been erected and equipped with three 50 kv.a., oil insulated, self-cooled, C. G. E. transformers stepping down from 22,000 to 2200 volts. This sub-station is of similar construction to the Callander sub-station of The Nipissing Power Company, which was illustrated and described in the columns of the Electrical News some months ago. The Nipissing Power Company now furnishes light and power in North Bay, Callander, Powassan and Nipissing.

April Meeting, Toronto Section A. I. E. E.

The monthly meeting of the Toronto Section of the A. I. E. E., announced for April 5th, has been postponed until Friday evening, April 12th, 8 p.m. The paper will be given by Mr. Wills MacLachlan, Belleville manager of the Trenton Electric & Water Company, on the subject, "The Electrical Installation of the Port Colborne Elevator."

The Makers of Electrical Canada—12

THOMAS REEVE ROSEBRUGH—MATHEMATICAL ELECTRICIAN

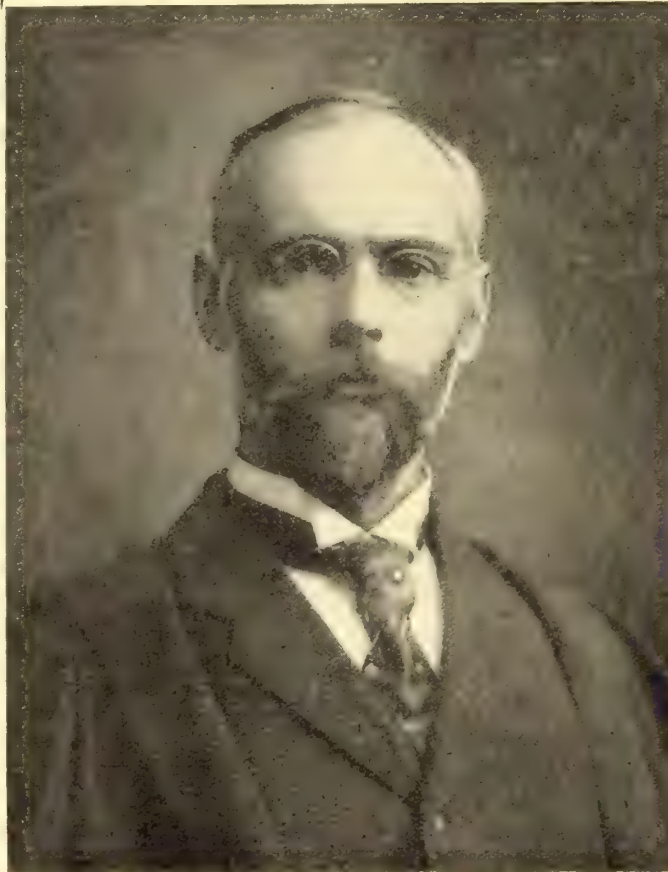
Industrially the world has seen greater changes in the last decade than during any similar previous period, due in very large measure to developments in Electrical Engineering. The advances made in the equipment for generation and utilization of electric energy not only stand out pre-eminently in comparison with progress along other lines, but it has been clearly demonstrated that the continued progress of practically all our industries is dependent upon its scientific control and use. And yet the last decade has not been specially marked by important discoveries, brilliant inventions, or the solution of any outstanding problems which had retarded previous progress. Developments have been uniform and continuous rather than spasmodic—the results of thoughtful investigation and application rather than the flights of genius. In this connection I wish to draw attention to the value of the university trained engineer.

I think we are apt to overlook the distinction between the crude though brilliant work of the men of genius who laid the foundation of the art and the skillful researches of the trained engineers who have perfected it, and give to the former credit that rightly belongs to those who have turned the basic principles of electricity to a practical and almost universal use. For this reason, some underrate the usefulness of our universities, for no university ever yet metamorphosed a common freshman into a genius. There is no university that graduates inventors. The tendency, indeed, would be in the opposite direction, since a university is operated along lines calculated to be best suited to the average student. The function of the university is not to create brain power but to nurture, develop and organize the crude materials that come within its influence. It raises the standard of the average; it turns out men of resource ready to lay hold on any unfinished problem and advance it a stage. The spirit of the university is steady advancement, that spirit that leads each graduate to approach his life's work with more than a determination—an instinct—to leave it on a higher plane than he found it. And that is where the electrical industry of to-day is, as compared with a decade ago—on a higher plane, that is all. But it is this higher elevation that gives the electrical man a panoramic view over the tops of all the other industries, showing him visions others cannot yet understand of the ultimate universal application of electricity for the betterment of humanity. If

the universities accomplish this are we sufficiently appreciative of the value of our universities. And, what then should our feelings be towards the teachers who give their lives up to university work that men may be trained and the march of progress may continue. Many of these teachers deny themselves the prospects of brilliant success along various commercial lines. Is it too much that we should respect them as philanthropists of the highest type, honor and appreciate the great work they are doing, and assist them by every means in our power to advance a work which is ours quite as much as theirs.

In saying that university graduates have played an all important part in the development of electrical science full credit must be given those men who, without the advantages of such training, have contributed their share to the progress of the electrical art. I know, and know of, a few such whose work is equal to the best the university graduates have done. This, however, is the result of an ability akin to genius; a university course may have spoiled them. In addition to these there are many non-graduates doing good average work, but these men, good as they now are, would have been better men with a better training.

The writer is free to confess that these thoughts have been brought more prominently to mind by a recent renewal of a somewhat casual acquaintance with the Electrical Engineering section of the Applied Science department of the University of Toronto, where one sees on every hand the most assuring indications of that



Professor T. R. Rosebrugh

forward movement which every department of this university, in a greater or less degree, is now giving evidence of. It is not in the building itself, which, from the modern viewpoint, has quite outlived its usefulness. It is not so much the equipment, which has never been provided with the extravagant disregard for cost that characterizes some wealthier institutions. Rather it is in the apparent determination of the School to give a good account of itself, the spirit of work and progress that gets a hold on every student. After all we judge the work of a factory by its product, and the product of the School without doubt ranks equal with the best the universities of the world are producing. The most casual observer can verify this statement in two ways. First, the rate of growth of attendance from 93 in 1890 to 231 in 1900 to 790 in the present year indicates the opinion of the student body. Second, important positions, the world over, are held by the graduates. If

This latter fact is all the more gratifying when one considers that the number of graduates was, comparatively with other universities, small until a very few years ago. Then it was not until 1906 that the Ontario Government relinquished direct control of this department, an arrangement which had not been ideal. The recognition of the requirements of the Electrical Engineering Department especially seems to have been far too long delayed, for it was not until 1909 that this was separated from the mechanical side and Professor Rosebrugh was free to devote his whole time to electrical work. The phenomenal progress of the School therefore cannot be said to be the result of circumstances, but rather in spite of them. It may be stated here that the ratio of students in the electrical engineering course is more than twenty-five per cent. of the total attendance, and this year the freshman class reaches the record number of eighty-one.

Of the many whose good work has helped to bring the School to its present state of efficiency the most interesting figure, to the electrical reader, is T. R. Rosebrugh, Professor of Electrical Engineering in the Applied Science department of the University. His appointment dates back to the year 1890, so that he has grown up with the School. Perhaps it would be more accurate to say the School has grown up with him, for the rapidity of its growth and the expansion and efficiency of the particular department over which he has charge both furnish conclusive evidence of his technical knowledge, his mathematical ability and his administrative skill. To meet the requirements of this position the university needed a man of practical inclination and experience combined with an intimate knowledge of the mathematical theory of the subject. Either qualification is separately obtainable, but their combination in one individual is rare, and in this respect Professor Rosebrugh occupies a unique position in that he possesses in a marked degree the necessary dual abilities. In pure mathematics or in practical engineering he would have been equally successful, and the School reaps the benefit of a combination rarely obtainable. That he is only forty-five years of age fills us alike with admiration for what he has accomplished and with confidence in what the years to come will bring forth.

Aside from his university work the Professor has found time to be an active member of the Toronto Section of the A. I. E. E., where the monthly meetings rarely fail to find him, and where his suggestions and contributions add much to the intellectual value of the evenings. Indeed, he was largely instrumental in the organization of the Toronto section, having been an associate member for some time previous. He has also added much to the literature of his subject, two of his most recent contributions being papers, written in collaboration with Dr. W. Lash Miller, on the mathematical presentation of certain valuable information relative to electro-chemistry. And in this latter connection, by the way, Professor Rosebrugh has been deeply interested, and specially helpful, in the establishment of a separate electro-chemical department, now under the control of Dr. Miller. The wisdom of this move is early shown in the rapidly increasing use of electro-chemical and electro-metallurgical processes along various industrial lines, and possibly no more valuable department of the university now exists than that presided over by Dr. W. Lash Miller and his brilliant co-worker, Dr. Saul Dushman. In his own department, too, Professor Rosebrugh has been most happy in the choice of his assistants, to the chief of whom, Mr. H. W. Price, recently appointed associate professor, a large measure of the success of the Electrical Engineering department is justly due.

Professor Rosebrugh is Toronto born, son of a Dr. A. M. Rosebrugh of that city, who was instrumental in the

organization of the first telephone company in Toronto, in 1878, afterwards bought out by the Bell company. The Professor took an early interest in these matters and his name appears, jointly with his father, on two United States patents on a "Combined Telegraph and Telephone Circuit," and on a "Multiple Telephone Circuit" (now called a phantom circuit), dated 1885 and 1889 respectively. He was educated at Jarvis Street Collegiate and at the University of Toronto, taking the honor course in Mathematics and Physics, and later the civil engineering course at the then School of Practical Science. After some time spent in practical engineering work he returned to the university in 1890, where he has ever since had charge of the building and operation of the Electrical Engineering laboratory and of the lecture courses in connection therewith. Among the makers of Electrical Engineering Canada no man holds a more prominent place.

Personal

Mr. Arthur S. Herbert, Canadian manager Messrs. Siemens Bros. Dynamo Works, Ltd., has just returned from a trip to Europe, in connection with the business of the Siemens companies.

Mr. R. M. Reade has been appointed superintendent of the city division of the Quebec Railway, Light, Heat & Power Company, succeeding Mr. A. J. McDonald, who recently resigned.

Mr. H. D. G. Crerar has resigned his position as chief engineer of the Canadian Tungsten Lamp Company and is at present one of the assistant engineers of the Hydro-electric Power Commission of Ontario.

Mr. E. Sterling, for some time past manager of the Lulu Island lines of the B.C.E.R., has recently been made divisional superintendent of the interurban lines. He will act as assistant to General Superintendent Franklin.

Mr. J. B. Ranie, who has been connected with the street railway system in Vancouver for twenty years past, latterly as traffic manager of Vancouver lines, has lately been promoted to the newly created post of general traffic agent. Mr. James Hilton, formerly engaged in street railway work in Montreal, has been appointed as Mr. Ranie's successor.

Mr. George J. Brown, recently of the Portland Railway, Light & Power Company, has left that company to join the Mitchell-Gray Electric Company, of Winnipeg, as superintendent of construction. Mr. Brown is a graduate of the University of Minnesota Engineering Department, and has worked for a number of large contracting concerns in St. Paul and Minneapolis.

New Books

Power House Design,—by John F. C. Snell, vice-president of the Institution of Electrical Engineers. Messrs. Longmans, Green & Co., publishers; supplied through their agents, the Renouf Publishing Co., 25 McGill College avenue, Montreal. Price \$6, postpaid. A very successful endeavor has been made to give all the requisite practical information on power house design, thus saving for the engineer the loss of time which results from searching through a number of different text-books which deal only with special features. The book will be found of great value to engineers, whether civil, mechanical, electrical or mining. It is well illustrated.

The Canadian General Electric Company has just issued its report for the year ending December 31st, 1911, showing gross earnings of \$1,405,889, an increase over the previous year of more than fifty per cent. Net for 1911 is \$889,745, as compared with \$646,300 in 1910.

The Term "Power Factor" Explained

In Answer to a Number of Enquiries from Central Station Operators, the meaning of the Term is Made Clear

By Mr. E. Richards

In the direct or continuous-current circuit certain well known relations exist between the various quantities involved. These relations are expressed by what is known as Ohm's law which states that

$$E=IR.$$

where E is the voltage or electro-motive force in volts, I is the current or flow in amperes and R is the resistance in ohms; also

$$W=EI.$$

where W is the power in watts.

All these quantities in the direct current circuit have fixed or continuous values and these simple relations apply generally and are the basis of every calculation required in connection with d.c. currents.

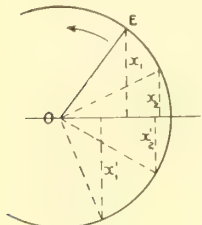


Fig. 1

When we come, however, to deal with the alternating current circuit we find matters very much more complicated and though the above laws are still applicable the conditions governing their application are much more complex. In the alternating current circuit, as indicated by the name, due to the nature and characteristics of the a.c. generator the voltage and current strength undergo continuous changes in values. These changes are periodic, recurring in a definite manner depending on the construction of the generator. This series of changes in all well designed generators approaches more or less nearly to what is called a sine wave. The meaning of this term may be explained as follows:—

In Fig. 1 suppose the line OE to represent the maximum value of the electro-motive force and that this line is revolving about the point O at a uniform rate equal to the frequency of the circuit, one revolution corresponding to one cycle. Also suppose that the perpendicular distances of the point E viz., x_1 , x_2 , &c., above the horizontal line represent positive values of the electro-motive force, and that the perpendicular distances below this line x'_1 , x'_2 , &c., represent negative values of the e.m.f. As this line OE revolves these perpendicular distances have constantly changing values as shown in Fig. 1 which may be represented graphically as in Fig. 2 where the horizontal distance between b and c represents a cycle or one complete revolution of OE and where the instantaneous and constantly changing values of x are plotted as positive or negative values above or below the line. A curve formed in this way constitutes a so-called sine wave.

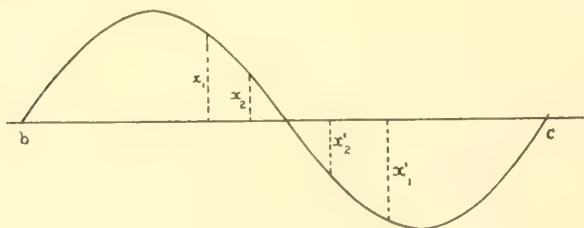


Fig. 2

While the above remarks have special reference to regularly recurring changes in the values of the electro-motive force, they are equally applicable to values of the current strength.

That is, the periodic changes in I may be represented also by a sine wave of the same general form as that shown in Fig. 2 and differing from it only in that the actual values of I and E at any given instant would not be represented by vertical lines of the same length. Plotted

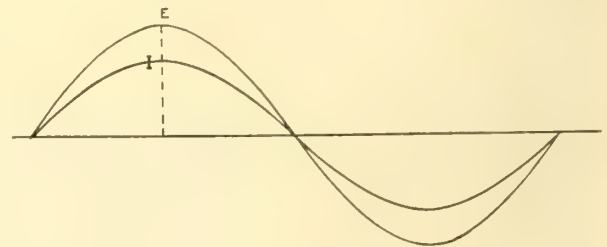


Fig. 3

in the same diagram the two corresponding sine waves would on first thought, be expected to appear somewhat as in Fig. 3; this however is rarely the case on account of the inherent characteristics of alternating current apparatus as will now be explained.

In all alternating current circuits containing inductive apparatus such as induction motors, transformers, etc., the current does not reach its maximum or zero or minimum values at the same instant as the electro-motive force attains these values. As a general rule the current lags behind the e.m.f., though the opposite may, under certain circumstances, be the case. It follows then, that the wave forms of E and I when plotted together do not appear as in Fig. 3 but as in Fig. 4 where, if we suppose the wave travelling from left to right, the I wave takes any certain value a short space of time after the E wave has attained the corresponding value.

This failure of the two sine waves to synchronize or coincide with one another results in a loss of power which

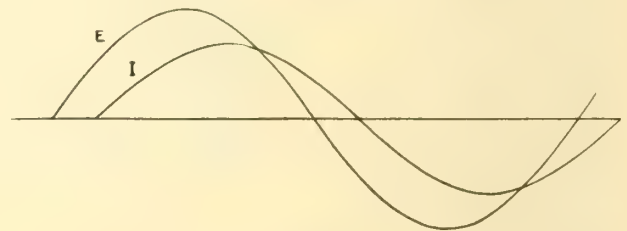


Fig. 4

graphically may be shown in the following manner:—Suppose Fig. 3 actually did represent the E and I waves on an a.c. system. Then, since the power $W=E \times I$, the amount of work done by the system is represented fairly by the shaded areas in Fig. 5. There would be no negative values of W for the reason that I and E are either both positive or both negative, resulting always in a positive product.

Now plot, in the same way, the work done under the conditions as shown in Fig. 4, where the I wave lags behind the E wave. This is done in Fig. 6 and shows that there is here a certain amount of negative work performed, as indicated by the shaded portions below the line. These negative portions result from I and E being found for a time on different sides of the line AB, that is, one being positive and one negative, resulting in a negative product. It can fur-

ther be seen that this unfavorable factor becomes more prominent as the lag of I behind E increases. Should this lag become as great as a quarter of a cycle the areas representing work become of equal size above and below the

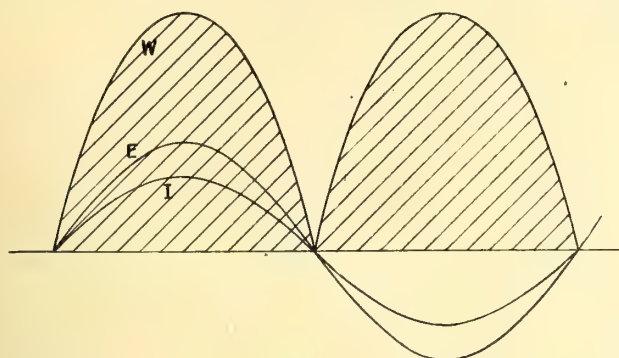


Fig. 5

line—which means that the system is doing no useful work at all.

The term “power-factor” is used to describe the extent of this loss of useful work. It is the percentage the total useful work done (as shown in Fig. 6) is of the total theoretical work done (as shown in Fig. 5).

While the above is probably the simplest conception of

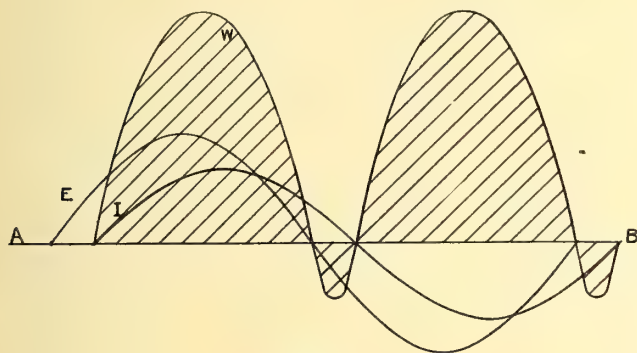


Fig. 6

what power-factor really is, it is not the method usually adopted for its expression, another graphic and somewhat more mathematical representation being found more suitable under average conditions:—

It was shown in Fig. 1 that the changing values of the e.m.f. are often represented by a line OE revolving about the point O , a complete revolution corresponding to one cycle of e.m.f. changes. In the same way the changing values of the current may also be represented by a line OI revolving about the point O , a complete revolution corresponding to a cycle of current changes. If the changing values of current and electro-motive force were in phase as in Fig. 3 the lines OE and OI would lie along one another. However,

as they rarely are in phase but are as shown in Fig. 4, OE and OI will stand apart by a small angle as shown in Fig. 7.

Under these conditions it can be shown that the power value of the system instead of being $E \times I$ as it would be if the waves synchronized, is only $E \times I \times \cos a^*$ (the value of

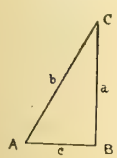


Fig. 7

* In any right angled triangle the cosine of either of the acute angles is the ratio between the two lines containing it, the side opposite the right angle being taken as denominator. Thus in the accompanying figure the cosine of the angle A (written $\cos A$) is $\frac{c}{b}$ and the cosine of the angle

C (written $\cos C$) is $\frac{a}{b}$

$\cos a$ is never greater than unity) and the ‘power-factor’ according to the definition already given, becomes

$$\frac{EI \cos a}{EI} = \cos a.$$

New Companies

The Bathurst Electric & Water-Power Company, Limited, is making application to the Legislature of New Brunswick, for power to increase its capital stock and to construct a power plant at Tetagouche Falls.

Application has been made to the Legislature of New Brunswick for the incorporation of the Gloucester Light & Power Company, Limited. The project of the company is to operate an electric light plant in the town of Bathurst and vicinity.

The Canada Gazette contains notice of incorporation of the New Orleans and Grand Isle Traction, Light and Power Company, with a capital stock of \$10,000,000. The company will deal in telephone lines, water-power development, street railways, etc. The head office is given as Toronto.

The Gibson Electric Limited has been incorporated with a capital of \$40,000, to carry on business as machinists, electricians, manufacturers of motors, etc., with head office at Toronto. The provisional directors are J. E. Murphy, Jr., J. A. McAndrew and H. H. Davis, all of Toronto.

Quain Electric Company Limited has been incorporated with a capital of \$50,000 to carry on business as electrical and mechanical engineers, to instal electric light and telephone systems, to build and operate tramways and contract for supplies of electric light and power. The head office is at Cranbrook, B.C.

The Bedford Light Company, Limited, of Bedford, Que., has been incorporated for the purpose of taking over the electric light plant of the town of Bedford and operating it under a franchise to be granted by the town. Powers are also asked to extend operations to towns and villages in the counties of Missisquoi, Brome and Shefford and to erect hydro-electric works.

Hamilton Hydro-Electric Department

The contracts for the transformers required in the distribution system in Hamilton have been awarded as follows:—For all sizes up to and including 20 kw., the Packard Electric Co.; all sizes between 25 and 40 kw., Canadian General Electric Co.; 50 and 75 kw. and intermediate sizes, the Canadian Westinghouse Co. The contract for meters has not yet been awarded pending further tests yet to be made.

The installation of the feeder system is proceeding rapidly and the apparatus is being installed in one of the sub-stations by the Canadian Westinghouse Company. This station will have a present capacity of 750 kw. in transformers and is designed to feed the manufacturing district, being located at the corner of Trolley and Gilkinson streets, in the northeast part of the city.

The Clermont Sewer Pipe Company have delivered in the neighborhood of 100,000 feet of duct, but as yet no underground work has been commenced. This work has been held up pending legislation, which it is expected will be passed by the Ontario and Dominion Houses, simultaneously, with respect to all companies operating in any city whether under Provincial or Dominion Charter, using the same ducts.

A Conversion in the Cement Industry

The Electrical Installation of the Canada Cement Company's Mill at Belleville—Many Advantages Over Steam

By Mr. F. C. E. Burnett

In the contest for the field for bulk supply of electricity, the hydro-electric power station is the centre of a circle whose radius is inversely proportional to the interest on capital expenditure on water works, power house, transmission lines, and sub-station, plus the small operating and maintenance costs, and directly proportional to the interest on capital expenditure on the equivalent steam or gas station, with their relatively larger operating and maintenance costs. All power required inside this circle must eventually come into the net of the hydro-electric station, except where the case is complicated by the necessity for large quantities of steam for heating in manufacturing processes.

When the Lehigh Portland Cement Company decided to build their cement mill at Belleville, there was no supply of power available from any hydro-electric station in that neighborhood sufficient to meet their requirements, and consequently power had to be generated from coal. The mill was put into commission in 1907 as a steam operated mill, but when the Canada Cement Company, Limited, took over the plant in 1910, the case had been altered by the advent of the Seymour Power Company into the field, and a contract was entered into between the two companies for the operation of the plant by electric power transmitted from Campbellford and Trenton.

The mill was originally driven partly by steam engines directly coupled to line shafts, and by electricity where the drives were some distance from the steam generating plant. In the engine room were two 1,200 h.p. cross compound Corliss engines, driving, by belts, the main shafts in the raw and clinker-grinding departments, two 500 kw. steam driven alternators, one 120 h.p. single cylinder Corliss, driving the machinery in the kiln room, and the usual complement of pumps and air compressors.

The system chosen for the electrical portion of the power supply was 550 volt, 60 cycle, three-phase, which is probably the system best adapted for this class of work, and therefore this portion of the power equipment was left unchanged when the old steam plant was discarded and the power supply taken from the lines of the Seymour Power Company. The departments originally motor driven were the quarry, stone-crushing, clay-handling, dryer buildings, coal grinding, pack house, and machine shops, the combined capacity of the motors connected in these departments being about 1,100 h.p.

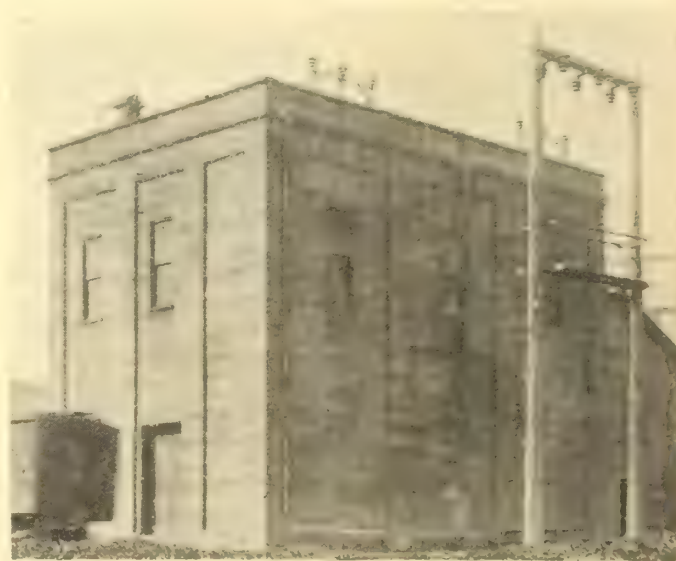
To supply power to the mill, the power company built a sub-station on the cement company's property close to the heaviest part of the load. The transmission line potential is 44,000 volts, and to reduce this to the mill voltage, the power company installed four 750 k.v.a. transformers, with all the necessary high and low-tension switch gear. The transformers are of the Canadian General Electric Company's standard oil-insulated, water-cooled type, set in concrete compartments in the transformer chamber. On the same floor of the sub-station, in an adjoining room, is placed the low-tension switchboard, which is of the C. G. E. Co's make, the panels being of blue Vermont marble, mounted on pipe supports, of a total height of 90 inches. The low-tension panels control the four transformers, a 600 k.v.a. synchronous condenser, four large motor panels, five two-circuit feeder panels, lighting generator and lighting feeder panels.

Over the transformer and switchboard rooms is placed the high-tension room, containing the 44,000 volt bus-bars

and high-tension switches and lightning arresters, the arrangement of which is of the latest type, designed to give greatest safety in operation, combined with ease of control. The whole of the sub-station was designed by the consulting engineers of the power company, Messrs. Smith, Kerry & Chace.

The problem of converting the main drives from steam to electrical was no easy one; the layout for steam group driving is entirely different from that usually adopted for electrical unit driving. The engine used for driving the clinker mill was belted to two main line shafts, one on the north and one on the south side of the mill, from which the griffin and tube mills, with their complement of elevators and conveyors, were driven. The plan adopted was to drive each line shaft separately by two 600 h.p. induction motors. The grinding mills, consisting of griffin and tube mills, were all driven through clutches, while the conveyors and elevators were belted direct, but were later separately driven by small motors for convenience in operation. In the raw mill, the arrangement was somewhat similar, except that the engine was belted to one long line shaft, which was split in two, and two 600 h.p. motors again used, to drive each portion of the shaft. The mills driven in this case consisted of komminuters, or ball mills, and tube mills, clutch driven, with their complement of conveyors and elevators.

Owing to the dusty atmosphere, and the necessity of safeguarding the large motors as much as possible, they are all separately housed in motor rooms, and the large belts and pulleys boxed in, to isolate the motors as much as possible from the grinding departments. There is also a supply of air at each motor, and they are regularly cleaned,



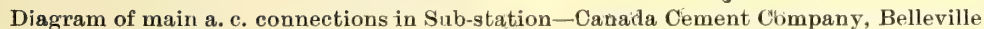
Electric Power Co's. Sub-Station, Lehigh Mill

to prevent the air ducts becoming choked, and to avoid accumulation of moisture-collecting dust about the windings.

As the torque necessary to start the line shaft alone, all clutches being released, was only a small proportion of the full load torque, it was decided to install squirrel-cage motors having a very high efficiency and power factor. The motors chosen were of the Canadian General Electric Com-

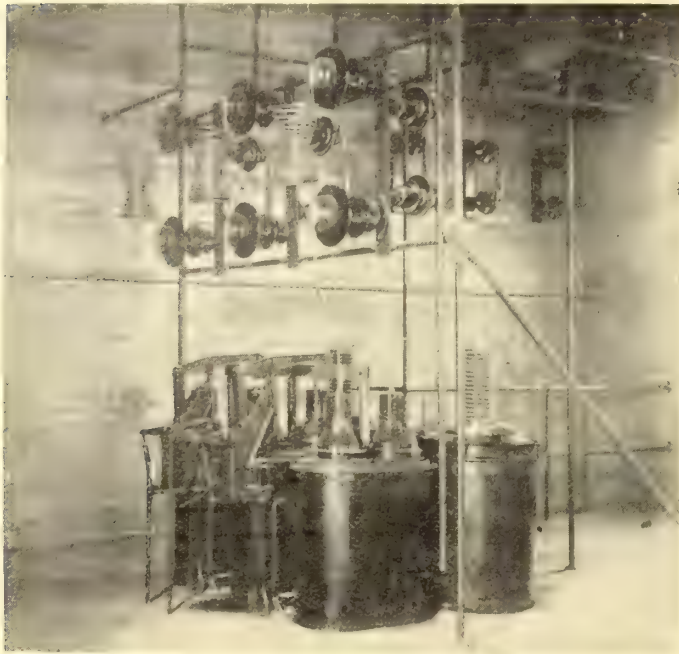
Provision had also to be made for the supply of water for general and fire purposes, which had been previously met by steam pumps in the boiler room of the old steam equipment, which had drawn their supply from a canal leading to the Bay of Quinte, some 300 ft. away, and which was kept from freezing in the winter by allowing a portion of the condenser discharge to overflow into the bay near the inlet to the canal. Under the new scheme, however, there would be no hot water to fulfill this useful function, with the result that the water supply canal would be frozen up solid as soon as the frost came. A pump house had there-

The smaller Corliss engine driving the whole of the kiln room was replaced by three induction motors, one, of 75 h.p., being belted to the kiln line shaft, which turns the rotary kilns, and operates the feeding gear for the raw material; another motor, of 35 h.p., drives the coal feeders, and the third, of 50 h.p., drives the blowers for the supply of air for blowing the coal into the kilns. The 35 h.p. motor also



fore to be built at the water's edge, some 20 ft. from the shore, and the bottom deepened to ensure a regular supply in the hardest winter. This pump house had also to be built strong enough to withstand a possible ice-shove, which often occurs when the ice in the bay breaks up in the early spring, with the wind in the south-west, and, as the point on which the mill is built is very exposed, everything in the way of the ice is swept away. An ordinary structure has no chance of surviving one of these ice shoves. In this pump house are installed two Watson-Stillman "Twinvolute" pumps, each of 750 U.S. galls. capacity, and each coupled to a 50 h.p. induction motor, of the Canadian Westinghouse Company's manufacture. For ordinary service, these pumps are run alternately, either being more than large enough for

all ordinary purposes, having an effective head of 150 ft. For fire, they are coupled in series, and give an effective head of three hundred feet, thus giving an ample pressure to deal with any outbreak in the mill or neighborhood. Whilst the pumps are each supplied with foot valves of first class design, they are further safeguarded by having a priming tank in the pump house, which is automatically



H. T. Switchgear and Wiring for one line

kept filled from the main supply pipe, thus ensuring the operation of the pumps immediately in case of emergency.

The supply of water for cooling the transformers is entirely independent of the main water supply, there being a small pump house near the sub-station, with its own complement of pumps and piping, but the supply can also be taken from the mains if necessary.

Beyond these, there were no other alterations necessary in the motive power of the mill, and there was no alteration to the general wiring of the plant. The feeder panels from the old switchboard in the engine room were removed to form a part of the new low-tension switchboard in the new sub-station, and the old feeders were extended to connect to their panels in the new location. All this work was carried out with only about 24 hours loss of time for the whole mill, the loss of time for changing from the old steam drive to the motors being negligible, as everything was first made quite ready before any change was made. The large motors were first connected and run on test, before they were belted to their main pulleys, and, after the belts were put on, they were driven light by the engines to take out some of the stretch before going regularly into commission. Then, when the steam plant was finally put out of commission, the new system went into operation without a hitch, everything going well and in good order. Putting on the large belts, of course took up more time, but this did not shut down the whole mill. For each department, the time out of commission was about 48 hours, this being necessary to make the joints in the belts in a satisfactory manner, as the change was made in the middle of winter.

In an annex built on to the sub-station and connecting it to the clinker mill, are two rooms, one of which contains one of the 600 h.p. motors for driving the clinker mill line-shaft. The other contains a 600 kv.a. synchronous condenser. This has coupled to it a 90 kw. d.c. generator, for the mill light-

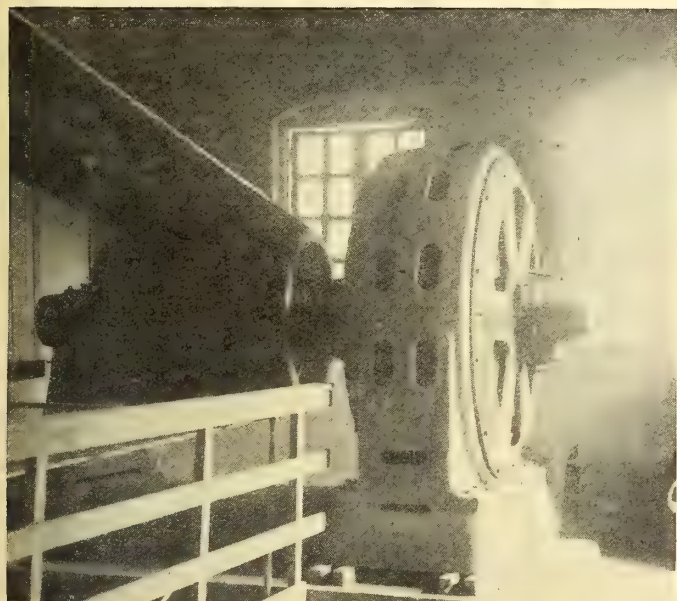
ing, but beyond this, the condenser floats on the line all the time, to raise the power factor to a higher point than would otherwise be the case, thus reducing the line losses, and improving the regulation of voltage at the substation. The power component of the load is so small that the whole of the 600 kv.a. is available as magnetizing current locally. The condenser is started up as an induction motor by means of a starting compensator, and when near synchronism the field switch is closed, bringing the set into synchronism, when the compensator is cut out, and the condenser thrown directly on the line. The starting and running switches are interlocked, ensuring that the compensator be cut out before condenser is connected to the line. The condenser panel on the switchboard contains an indicating power factor meter, showing the power factor of the total input to the station, and, alongside the panel, there is a pedestal containing a Tirrill regulator, to maintain the power factor constant at a predetermined point. In actual practice, however, it has been found that this was hardly necessary, as the load is so constant that there is little variation in the power factor of the whole load. The large motors with their high characteristics contribute not a little to the maintenance of the good power factor obtained, and the load on them is very steady, in addition to which there is not much change in the power factor of the motors themselves over a wide range of load. The average power factor obtained on



L. T. Switchboard with 600 kv. a. Condenser in Background

the whole system is about 93 per cent., being fairly constant for each month of normal working. In addition to the indicating power factor meter, there is a recording instrument for the same purpose, and two single phase integrating wattmeters also give the average power factor by means of the usual well known method, which is probably the most

accurate that we possess. These two instruments are connected up in the usual way to read the total input in kilowatts, by adding the readings. There is also an overload relay in the main circuit to which is connected a bell circuit, indicating when the load reaches an amount in excess of the normal maximum, and thus warning the attendant to reduce the load immediately; the power contract is based on the maximum peak load for a given time, which gives the staff a reasonable opportunity to cut it down to their



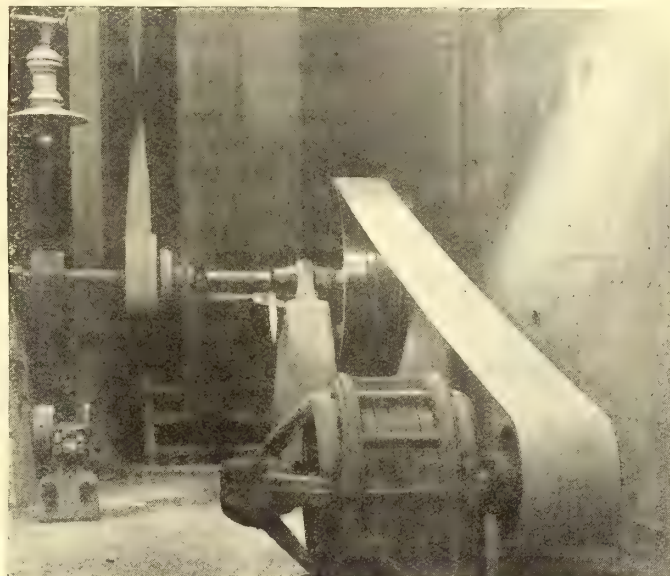
600 h. p. Induction Motor driving east half of raw mill

normal requirements without being penalized for conditions which are only temporary.

The normal maximum load of the whole plant under the new conditions is about 3550 h.p., during the shipping season, and this load is maintained fairly steady during the summer months. The average load factor for an average day is generally about 90 per cent., and the load factor for the whole month is in the neighborhood of 80 per cent., which is really a remarkable performance, and forms an ideal load for a power station. The mill, of course, works for twenty-four hours per day, and seven days a week, and the conditions for economical power supply are as good as can be obtained anywhere. The power charts show on several occasions that the load has been maintained at about 90 per cent. load factor for seventy-two hours at a stretch, a condition which the writer has not come across in any other industry. This, however, is exceptional, as there must be time taken to maintain the equipment of the mill, and all this tends to lower the load factor, which could be maintained at this high level indefinitely but for the need of making repairs to belts, gears, etc. Then, in an equipment of this kind, where there is group driving, it is necessary to shut down a complete large motor unit when repairs have to be made to the drive for any single machine. There are clutches to each machine, but these do not take care of the repairs which may be necessary to belts, or to the clutches themselves. Against the loss of time that occurs through the shutting down of the whole unit, there is a corresponding gain due to the fact that all the main belts pass over very large pulleys and this tends to lengthen the life of the belt to quite a considerable extent, and also gives a more efficient drive for the whole department. When individual drives are adopted the belts run over pulleys that have a fairly large ratio, and hence there is loss of time due to their maintenance, and a corresponding loss of power through greater aggregate belt losses, and the losses due to

the employment of smaller motor units. From an operating point of view, however, the individual drive system is preferable, and the other is only justifiable when power is expensive, or, as in the present case, where there has been a change made from steam to electric driving, with the original lay-out designed to give the best possible results for the drive adopted. There is another disadvantage in group driving, due to the concentration of power in one unit. Should one of the large motors break down for any reason, there is considerable loss of time and production until such time as it can be repaired, usually a long time, when the motor is of such a large size, with heavy windings. In the case of individual drives, a motor break-down is not of such moment, as spare motors are generally kept on hand, ready for such emergencies and one can be changed in a very short space of time. There is, of course, not the same chance of the larger motor going out of commission, while break-down of the smaller sizes is of comparatively frequent occurrence.

Since the adoption of electric power throughout the mill, the operation has been very satisfactory from all points of view. There have been few interruptions to the power supply during the lightning season, in spite of the fact that the power company's lines extend over a large area. The last season was a specially bad one for lightning storms, but



75 h. p. Induction Motor driving Kiln Line Shaft

there was little trouble, and the only shut-downs occurred from severe direct strokes. All others appeared to be well taken care of by the protective devices.

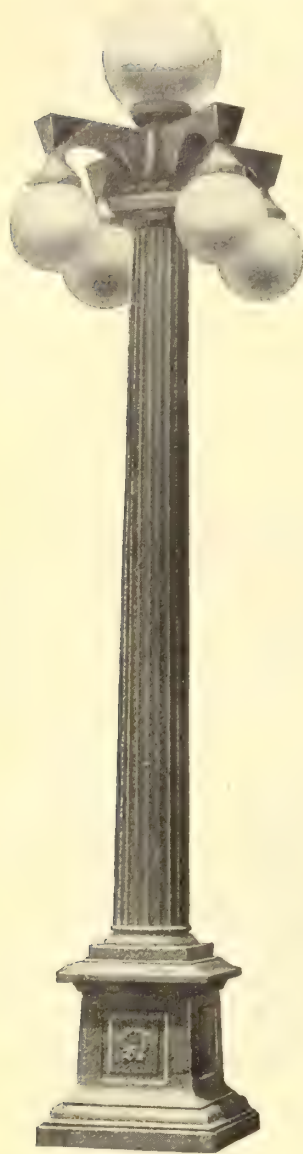
Since the original steam equipment was superseded, a few small motors have been added to the electrical equipment, for minor changes in the mill.

Plucky Railroad Man Had Thrilling Ride

Brakeman Blythe, employed on the Vancouver-Chilliwack line of the British Columbia Electric Railway, had a hair-bleaching experience on a recent trip. A box-car loaded with lumber on which he was stationed broke loose from the train at Mount Lehman, where there is a heavy down-grade. On trying the handbrakes they refused to work, but Blythe remained at his post until the car—now travelling at the rate of a mile a minute—left the track and was reduced to splinters. Blythe was thrown forward clear of the wreckage, lighting upon a mound of soft earth with sufficient force to fracture two ribs. Very properly he was commended, in the official report of the accident, for the pluck shown in electing to remain on the car and endeavoring to apply the brakes.

Waterloo's Ornamental Street Lighting

An Installation that Compares with the Largest Cities—5-Light Standards Underground Conduit Work—60 and 100 Watt Lamps Used



Civic pride and municipal competition have been largely responsible for the development and installation of ornamental lighting systems. Civic bodies, municipal associations and business men's clubs are all eager to do something for their cities to attract attention and place their city or town in a class just a little above its neighbors.

Although so-called ornamental lighting has been in vogue for many years it is only within the past year or two that definite and positive developments along this line have taken place. Successive developments in underground service have been largely responsible for successive developments in decorative lighting. Approximately ten years ago the change from overhead to underground wire brought about the change from enclosed arc lamp span or centre street suspension to suspension from more or less ornamental shepherd's crook poles. Following the pole suspension of arc lamps we find the growing popularity of the festoon arrangement. This produces a carnival effect made by stringing streamers of incandescent lamps either across the streets or parallel to the curb lines. The festoon idea later developed into a more permanent system in the form of steel arches suspended across the

main business thoroughfares. Installations of this nature, while producing satisfactory night results, were not pleasing by day. A lighting system in the present age must be aesthetic as well as utilitarian.

The advent of high efficiency arcs and tungsten incandescents has revolutionized out-door as well as in-door lighting. The high efficiency of these units makes it possible to produce not only effective, but highly ornamental results—illumination, instead of simply light spots—a uniform glow instead of a glare.

Comparing the two outstanding systems of out-door illumination, the enclosed arc and the ornamental cluster with tungstens, the quantity of light for the same money seems to be much in favor of the arcs. This difference is so pronounced that it is not easy to understand why so many of the smaller towns throughout Canada are installing the more expensive system. Doubtless the explanation is to be found in the fact that the appeal the ornamental cluster makes to our aesthetic side is too strong to be counterbalanced by a question of mere dollars and cents. Street light-

ing by ornamental mazda or tungsten standards has proven remarkably popular in the past couple of years and has probably done more towards beautifying the cities and towns of our Dominion than any other single element entering into the general civic movement. This statement applies particularly to business district improvement or civic improvement by artificial means. In spite of the extra added cost the installation of ornamental standard lighting systems is within reach of the smaller cities and larger towns. Indeed, it is probably true that many of our Canadian villages will install this type of system. In the smaller places fewer lights are often installed, say, a three-light standard or a two-light, with perhaps five-light standards on the street corners. In the larger places five-light standards are now installed almost universally. The standards are placed about one hundred feet apart in common practice, though much depends on the width of the street. With standards this close, the illumination can be considered fair. If the most satisfactory results are required it is necessary to place the standards from fifty to sixty feet apart on a street of about the same width. The plan of staggering the poles or placing them along the street zig-zag is not now favored, unless the streets are very narrow.

One of the most modern and elaborate street lighting systems to be found in Canada has recently been installed by the municipality of the town of Waterloo, Ontario, and the illustrations shown herewith indicate the satisfactory results, both illuminative and decorative that are being obtained. All along Main street ornamental five-light standards are placed on both sides of the street and about one hundred feet apart. The poles stand exactly opposite one



Main Street in Waterloo—No Other Poles.

another on the two sides of the street. Each standard carries four sixty watt tungsten lamps and one 100 watt lamp. The four smaller lamps burn till 12 o'clock, midnight, the other lamp all night. Sixty-four of these standards have been installed to date but we understand it is the intention to place as many more in the near future along the street connecting Waterloo with Berlin.

The system of distribution for these standards is underground by a three-wire multiple circuit with relay switches



Main Street, Waterloo, at Night—5-Light Standards both sides, every 100 ft.

controlled from the station. The underground work is placed in two-inch loricated conduit. Fuse blocks are placed in the base of each standard. No transformers appear on the main street at all, but these have been installed in the lanes so as to be removed as far as possible from view.

The shades are Alba glassware, the upper one being sixteen inches and the four lower ones twelve inches in diameter. The standards are of pressed steel specially designed to withstand the hardest kind of usage, and it is claimed that none of these poles ever get broken, as is frequently the case with the cast-iron pole. Indeed, the company states that a test is always allowed with a 20-lb. hammer before these standards need be accepted.

The town of Waterloo was also well advised in installing its underground work at a time when the paving of the street was taking place. It not infrequently happens that

municipalities just get their streets nicely paved when they decide to do some underground work, with the result that the street can never be placed in as good a condition again. The appearance of the Waterloo street certainly repays the care and foresight exercised in this direction. In the photographs of the main street it will be noticed, too, that there is no other pole of any kind to be seen, though the electric railway passes down this street, the trolley wires being carried on cross stays suspended from the walls of the building on either side of the street. This device has resulted in a very neat appearing effect.

The Waterloo system was laid out by Mr. F. H. Rogers, of the Adams-Bagnall Electric Company, and installed by Mr. George Grosz, engineer of the town of Waterloo. The equipment was all supplied by the Adams-Bagnall Electric Company. The total cost approximated to \$108 per pole, covering the complete equipment.

The Cost of Isolated Electric Plants

As Generated by Non-Condensing Engines with Exhaust Steam Used for Heating During the Winter Season

Every isolated plant with exhaust steam heating must be considered as a separate problem, because of the wide variation in load, cost of coal, water, labor, etc. Where steam heating is required, electric power may be generated as a by-product of the heating plant, at a cost of less than 2c. per kilowatt hour in the majority of cases. The reasons for this low cost of generation may be summarized as follows:

(1) The fixed costs, which go to make up a large share of the cost of power, are chargeable only against the additional investment for the plant by which electric power is generated, over and above the investment for a low pressure steam heating plant.

(2) The coal cost chargeable against electric power is reduced, during those periods when the exhaust steam is used for heating, to a small percentage of the coal consumed, representing that part of the heat in the steam, which is lost between the high pressure boiler and the heating system.

(3) The labor charge comprises only the additional labor required, as compared to a low pressure heating plant. Furthermore, by reason of the additional labor, which is of a higher grade, greater economy is obtained in fuel consumption, amounting to a saving in coal of 5 to 15 per

cent., which in a plant of fair size will pay the wages of an engineer.

(4) While the charge for oil, waste, repairs, and miscellaneous items is incurred entirely through the installation of the engine and generator, they mount up to but a small proportion of the total expense.

The following case, which may be presented as a typical one, will serve to outline the calculations whereby the cost of power may be determined, and to indicate the influence on the cost per kw.h. of the three most important factors, fixed charges, price of coal, and the amount of exhaust steam used for heating.

Fixed charges.—An industrial plant operating 3,000 hours per year, with an average load of 200 kw. will be assumed. Two 100 kw., and one 50 kw. engine-driven dynamos installed with suitable piping and appurtenances may be set down at \$11,000. Two 200 h.p. boilers would also be required. However, the total cost of these boilers would not be chargeable against power, since boilers would also be required for the low pressure heating plant. The cost per h.p. of low pressure boilers, grates, stack, etc., is about the same as a similar high pressure equipment. However, as heat is lost and consumed between the high pressure boiler and the heating system, a somewhat greater boiler capacity

must be installed when power is to be generated. As the exhaust from an engine contains 80 to 90 per cent. of the heat given it in the boiler, an increase of boiler capacity of 20 per cent. over the low pressure equipment will take care of this item and also any additional cost of a high pressure boiler as compared to a low pressure equipment. Setting down \$18.75 per horse power, including boiler, grates, stack setting, piping and labor of installation, the additional boiler cost is 400 h.p. x 20 per cent. x \$18.75 equals \$1,500.

Of this total additional cost of \$12,500, a certain fixed percentage must be charged off every year against the cost of power. The fixed charge may be set down as follows:—

Interest at 5 per cent.	\$625.00
Depreciation at 5 per cent.	625.00
Insurance, real estate, upkeep, obsolescence, 5 per cent.	625.00

Total, 15 per cent. \$1,875.00

Labor, oil-waste, etc.—The cost for additional labor may be taken as one man at \$800 per year, while repairs, oil-waste, packing, etc., may be set down as \$250, making a total of \$1,050.

Coal.—The coal chargeable against power, comprises the coal equivalent of the heat lost between the high pressure boiler and the heating system when the heating season is on, and when no heating is being done, all of the coal burnt under the boiler is chargeable against power. The cost for coal will, therefore, depend upon (a) the steam consumption of the engines per kw.h.; (b) the efficiency of the boiler, or pounds of steam per pound of coal; (c) the cost of coal, and (d) the percentage of the total amount of steam generated which is used by the heating system.

Item (a).—Steam consumption may be placed at 30 lbs. per horse-power-hour (non-condensing), or 40 lbs. per kilowatt hour. To be on the safe side and to take care of the effect of reduced and fluctuating loads on steam consumption, assume 60 lbs. of steam per kw.h.

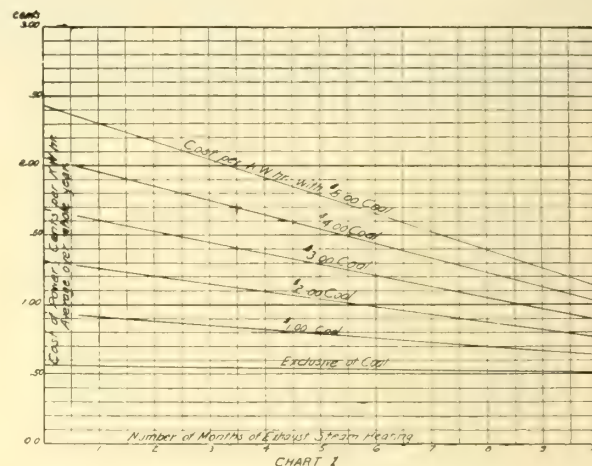
Item (b).—Assume boiler efficiency as 60 per cent., or about 8 lbs. of steam per pound of coal.

Items (c) & (d).—The cost of coal and the proportion of the total steam generated which is used in the heating system, are both variable. In the table given herewith, the cost of coal ranges from \$1 to \$5. The amount of steam used in the heating system is taken care of by considering the number of equivalent months of the year when all the exhaust steam is used for heating. During those months it is assumed that all the exhaust steam is used by the heating system. Strictly speaking, at the beginning and end of the heating season, there are periods when only a moderate amount of heating is required and only a portion of the steam exhausted by the engines is utilized. This decrease in heating load may be taken care of by assuming a shorter heating season. For example, suppose that for four months during the winter, all the exhaust steam was used in the heating season and that for one and a half months before and after this season the amount of steam used in the heating system varied from zero to full capacity. It would then be quite accurate to assume that the heating season of seven months would be equivalent, as to amount of steam used for heating, to a season of five and a half months in which the heating load was always equivalent to the full exhaust of the engine.

Water.—An average price for water is 10 cents per 1,000 gallons. During the heating season it is assumed that only eighty per cent. of the water is returned to the boiler. During other periods all the water is lost. It should be noted that it is assumed that in a low pressure heating system all the water is returned to the boiler, that is, there is no loss, and in setting down the additional cost for water when power is produced as a by-product, it is assumed that condensation in high pressure steam piping, condensation in the

engine, etc., results in a twenty per cent. loss during the heating season and when the steam is exhausted to atmosphere, a one hundred per cent. loss. With the fixed costs and labor cost already given, and calculating the coal and water charges for given conditions, the table and charts shown were obtained. The following example will serve to explain in detail the method of arriving at these figures.

Example.—Assume the heating season equivalent to six months of full load steam heating, during which all the exhaust is used. During this period the coal chargeable against power is the equivalent of the steam and heat lost between the high pressure boiler and the heating system. Assume that twenty per cent. of the heat of the steam is lost in this



manner. The other factors entering into the coal cost have already been given, i.e., load, 200 kw.; steam consumption, 60 lbs. of steam per kw.h.; coal consumption, 1 lb of coal per 8 lbs. of steam; hours per year, 3,000. With coal at \$4, we then have the cost for coal during the six months heating period, as follows:—

$$\frac{200}{1} \times \frac{3,000}{2} \times \frac{60}{8} \times \frac{1}{2,000} \times \frac{20}{100} \times \frac{4}{1} = \$900$$

The part of the year when there is no exhaust steam heating, and those parts of the year when only part of the exhaust steam is used for heating, are equivalent to six months of straight non-condensing operation. The cost of coal is therefore:—

$$\frac{200}{1} \times \frac{3,000}{2} \times \frac{60}{8} \times \frac{1}{2,000} \times \frac{4}{1} = \$1500.00$$

To this coal cost must be added the cost for water which may be set down at 10 cents per thousand gallons. During the heating season, the system returns 80 per cent. of the boiler feed. The cost for water is then (8.33 lbs. = 1 gal):—

$$\frac{200}{1} \times \frac{3,000}{2} \times \frac{60}{8.33} \times \frac{20}{100} \times \frac{10c}{1,000} = \$13.20$$

For the other six months the cost for water is as follows:—

$$\frac{200}{1} \times \frac{3,000}{2} \times \frac{60}{8.33} \times \frac{10c}{1,000} = \$216.00$$

We may now set down the total charges for generating power at the rate of 200 kw. for 3,000 hours a year, as follows:—

Fixed charge	\$1,875.00
Labor, oil and miscellaneous	1,050.00
Coal	4,500.00
"	900.00
Water	216.00
"	43.00

Total \$8,584.00

During the year there are developed 3,000 x 200 = 600,-

000 kw. hours, giving a cost per kw.h. of $\$8,584 \div 600,000 = 1.431$ cents.

In the same manner it is found that when the heating season is equivalent to only two months of full-load heating, the cost per kw.h. is 1.85c. For the same conditions when the price of coal is \$5 instead of \$4, the cost per kw.h. is 2.175c. In this way the table following was compiled.

Table I.

Cost of power per kw.h. in a typical isolated plant
Average load 200 kw.

Months of Exhaust Steam Heating	Price of Coal \$ per ton					
	\$0	\$1	\$2	\$3	\$4	\$5
2	.550	.880	1.200	1.525	1.850	2.175
4	.540	.820	1.090	1.365	1.640	1.915
6	.531	.755	.983	1.205	1.431	1.656
8	.521	.700	.871	1.046	1.221	1.396

Charts.—From this data the charts of Figs. 1 and 2 were prepared. In Fig. 1 the cost of power in cents per kw.h. (average over the whole year) is plotted against the number of months that exhaust steam is used for heating. Each line represents a different price of coal. With this chart in hand, we can study the influence of coal cost, length of heating periods, the influence of first cost and also of percentage of that cost which should be charged off per year in order to take care of interest, depreciation, etc.

Suppose, for instance, as has already been suggested, that instead of considering the additional cost of a high pressure boiler plant and engine, as against a low pressure boiler plant, we desire to find out the cost of power in a plant where a low pressure boiler is already installed and must be replaced. The additional first cost of the high pressure boiler over and above the low pressure boiler, taking into account the fact that a boiler of higher capacity would be required, was set down in the foregoing analysis at \$1,500. Assume that an entire new boiler would be needed costing five times this amount, or \$7,500. This would increase the

represents the cost for different lengths of heating periods. This chart is useful for investigating the effect of the price of coal and also the comparative effect of length of heating season and price of coal. For instance, the cost per kw. hour is practically the same for an eight months solid heating season with \$4 coal, as it is with a two months heating season with \$2 coal.

On reference to this chart, it will be noted that the cost, exclusive of coal and water are considered separately—being plotted against load factor.

A load of 200 kw., 3,000 hours per year, is considered as 100 per cent. load factor (although the plant capacity is 250 kw.). At 100 per cent. the fixed charge, labor charge etc., per kw.h., is $\frac{\$1,875 + \$1,050}{600,000} = .488$ cents. Similarly at 50 per cent. load factor the cost per kw.h., exclusive of coal and water is $\frac{\$1,875 + \$1,050}{300,000} = .976$ cents.

By similar calculations the complete curve is plotted, which may be used in connection with the curves at the right in order to study the cost of power under various conditions. Suppose, for instance, that the load factor is fifty per cent., then the ordinate "a" = 98 cents = fixed charge, labor, etc.; if the coal cost is \$4 a ton and the number of months exhaust steam heating is 4, then the coal and water cost per kw.h. is given by "b" which equals 1.17 cents and the total cost of power per kw.h. equals $a + b = 2.15$ cents.

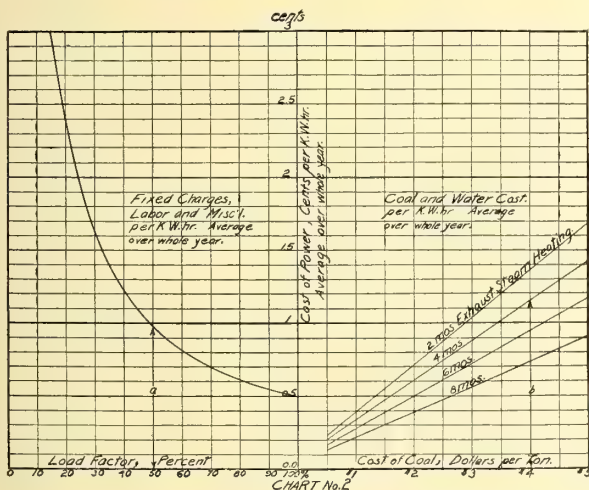
Now the question that naturally arises in the mind of the consumer of electric current is this;—if the isolated plant with its small capacity and efficiency, further decreased by the fact that it must exhaust its steam for a part of the year to atmosphere, can generate power for two cents a kw.h.—why is it, that the central station, in which maximum economy is obtained by cutting down all losses, generating in large units, operating condensing, etc., cannot generate power at a far less cost than this and sell it for a price approximating one to two cents per kw.h.?

The central station can produce power at its own switch-board for a cost, including both operating and fixed charges, of one cent per kw.h. But this is only a part of the total cost to the consumer, since it is necessary to have an elaborate and expensive transmission and distributing system of copper cable, feeders, sub-stations, etc., in order to deliver the power. The power house furnishes electricity to the distributing system, which acts as a carrier and which must pay interest, depreciation, franchise and maintenance charges just as must a railroad. As with the railroad, too, there is a natural tendency towards rate discrimination, and it is only the favored consumer who obtains power at a reasonable charge, while the other man bears the burden.

U. S. Government will Control Price of Lamps

It is reported that the United States Circuit Court, of Ohio, has instructed the General Electric Company as to the prices at which it must sell its electric lamps. This price is said to be fixed absolutely by the Court, which means that the General Electric Company cannot reduce its price even, without the consent of the United States Government. The General Electric Company control about 90 per cent. of the lamp manufacturing business of the United States and it is supposed that this hard and fast order is to protect the 10 per cent. of small independent companies. The price fixed is said to be about five per cent. less than the present current prices.

Mr. Mieville, Resident Engineer of Messrs. W. H. Allen Son & Co. Ltd., of Bedford, Eng., (who are represented in Canada by Messrs. Chapman & Walker of Toronto) has just left on an extensive tour of the west, and will call at all the leading towns en route.



additional first cost of the plant by \$6,000 and the additional yearly charges by 15 per cent. of \$6,000 or \$900, making the total fixed charge \$2,775, instead of \$1,875, and for 600,000 kw. hours per year, would increase the fixed charge per kw.h. from .312 cents to .462 cents, or an increase of .150 cents. The influence of this additional charge of .150 cents upon the cost of power with \$4 coal, and when three months' exhaust steam heating is used, is therefore an increase from 1.75 cents to 1.90 cents per kw.h.

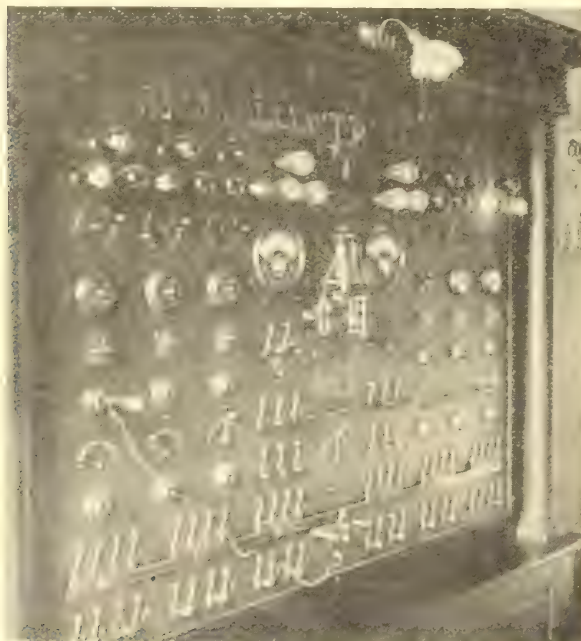
In the chart of Fig. 2 the cost per kw. hour is plotted against the cost of coal in dollars per ton, and each line

The Month's Activities in British Columbia

Vancouver's Police Patrol System

The inauguration of a private telephone and call system in Vancouver city to be operated solely for use in connection with the police department was first proposed by the present Chief of Police, Mr. R. G. Chamberlain, in the early part of 1909. Mr. Chamberlain made a thorough inspection of many systems in use in other cities, and finally recommended that the Gamewell police patrol system be adopted. Orders for the supply of a complete central office equipment and the furnishing of 60 patrol boxes were accordingly placed with the Gamewell Fire Alarm Company and Police Telegraph Company, New York. The work of installing the central office equipment in the police station was commenced October 15, 1909, and at the same time the wires were strung the poles of the local light and telephone companies being used for this purpose. Work was completed and the system put in actual operation on November 25, 1909.

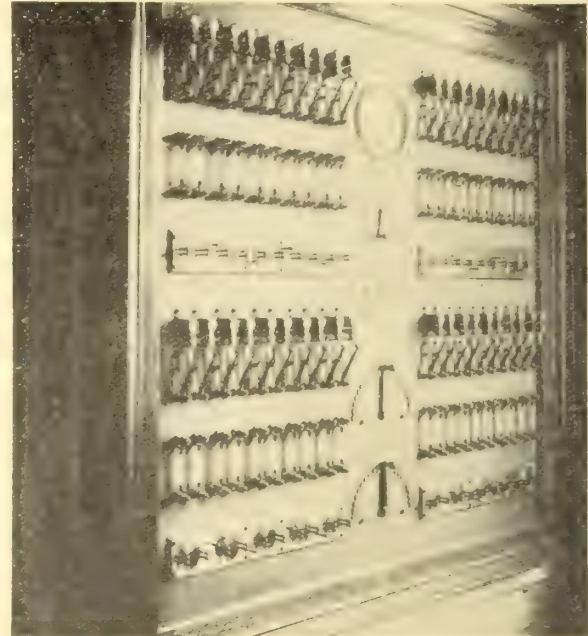
The power for operating this system is supplied by the B.C.E.R. Co. through a $2\frac{1}{4}$ h.p. 3 phase Canadian Westinghouse induction motor-generator set and storage battery. Current passes into the battery charging switchboard through a double pole self-closing magnet switch and, after passing through the lamp and regulating resistances, flows into the battery on charge. The cells are of the chloride type, and are 2 volt, 20 ampere hour capacity each. Ten of these cells are arranged in series on each call box circuit, 33 cells on the flash light circuits and four other circuits with voltages of 6, 10, and 12 for local circuits on the operating switch board. The batteries are arranged in duplicate so that when one battery is charging, the other is discharging, the change-over being made through a gang switch on the battery charge switch board.



Battery Charging Switchboard, Vancouver

Current discharges from the batteries into the operating switch board where, having passed through line relays, it flows to the protector switch board. This board is purely a protective device to safeguard the entire installation from damage against outside influences, and is especially necessary as most of the aerial lines of this system are strung

on poles carrying high voltage wires. On the protector board each line passes through an automatic magnetic switch, adjustable to any voltage, and a small capacity fuse before connecting to the outside lines. The board is also fitted with a ground detector circuit which shows a leak to ground on any line by moving a switch to the number of the line



Protector Switchboard, Vancouver

under test, and a battery reversing device making it possible to reverse the polarity of the line.

Since the system has been in operation, 65 additional boxes have been added, making a total of 125. Each box is provided with a patrol call by which it is possible to turn in an alarm call to headquarters without having to unlock the box or speak over the phone. This arrangement has been found very useful in cases where the patrolman is dealing with disorderly persons. The boxes are connected on each circuit in multiple series, on an open circuit system. The action in the box when transmitting a call is to short circuit the line as many times as necessary to transmit the number of the box in use, the call being recorded in the central office on a punch register. If the call is for the patrol wagon there is an extra perforation in front of the number; if a call is for telephone this comes after the number.

In order to call any patrolman from headquarters, during the day or night, flash light circuits are used. These circuits run from the central office to a pole near a patrol box. On the pole is mounted a red lamp and bell. During the day time the bell is sounded but at night time red flash lights are used. The flashlights are grouped 10 to a circuit and operate through polarized relays. The polarized relays are in series on a 75 volt line, grounded at each end. The current for ringing the bell and for the light is 110 volt a.c., taken from the local lighting system. The red light as a silent signal at night time has been found preferable to the bell. The change over from bell to light is effected by a throw-over switch on the operator's desk. There are approximately 95 miles of line work in use on this system, covering an area of about 13 square miles.

This system has been of great value to the police department and, when the utility and convenience are considered, the maintenance is low. Each patrolman has an appointed time to call headquarters, once every hour, this time being arranged so that calls from different officers do not conflict. Sometimes as many as 450 calls are handled over the lines in 8 hours. In order to relieve this congestion at headquarters and permit the locating of other boxes where needed in the business section of the city, it is proposed to install two more complete sets of equipment in the police sub-station.

As previously mentioned the largest portion of the lines are aerial, constructed on a special bracket secured to the top of poles, and so arranged as to allow 2 feet of clearance from all other wires. All the box wiring is in $\frac{1}{2}$ -in. conduit from the top of the poles to the box. Metallic continuity is broken at the box by a $\frac{1}{2}$ -in. McCallum insulating joint. The frames of the boxes are all grounded. Underground conduits are in use on the principal streets to supply current to the combination police patrol and fire alarm standards. The lines consist chiefly of No. 12 rubber covered, double braided, twisted pair wire. This construction has given good satisfaction and reduced line troubles to a minimum.

The system was installed throughout by Mr. C. Mulligan, who has charge of its operation at the present time. It is, in no small measure, Mr. Mulligan's careful and zealous work that has made the operation so successful.

Half a Million Dollars for Telephone Betterments

Estimates covering the work outlined for 1912 have just been completed by the British Columbia Telephone Company, and provide for a building program the scope of which is a most convincing proof of the rapid development that is to take place in Vancouver, the Fraser Valley and elsewhere. The improvements planned called for an expenditure of half a million dollars, and the carrying out of the work will demand the services of about 150 extra linemen and an immense quantity of material. The extensions in the exchange systems alone will require about 130,000,000 feet of copper wire in the form of cables, while the open wire systems to be located will call for a large additional amount. It will require 130 cars to bring this order from Montreal to Vancouver. The wire will be shipped in installments and strung into place as it arrives. The extensions to the toll line system call for six additional circuits between New Westminster and Vancouver, three between New Westminster and Mission City, and one between Victoria and Duncans, on Vancouver Island.

Jordan River Supplying Victoria

On February 15th the new contract entered into by the Council of Victoria with the Vancouver Island Power Company for power, came into effect, marking a substantial reduction in the rates for domestic lighting charged by the city. The present steam plant will be retained as a reserve in case of a break-down of the Jordan River service. A busy year is ahead of City Electrician Hutchinson, there being over \$200,000 worth of cluster lighting for which petitions have been presented and by-laws passed, while \$50,000 voted for street lighting last season, but which was not expended, will now be used in extending the arc lighting system. When the improvements are completed Victoria will be one of the brightest cities on the Coast.

Opposition to Increased Rates

The Okanagan (B.C.) Telephone Company, which recently acquired the local systems of all the Valley towns,

is meeting with spirited opposition to the proposal to raise the rate of business phones from \$2.50 to \$5.00 per month, and on residential phones from \$2.00 to \$3.00. Summerland subscribers agreed to cancel their phones upon being called upon to pay the new rate, and subscribed \$11,000 in a few days for the formation of an independent company. Penticton subscribers followed the lead of Summerland, and a number of citizens have signed up for stock in the proposed new company. The next move of the telephone company is being awaited with interest.

Nelson to Control Wiring by By-law

City Electrician Thomas, of Nelson, has stirred the aldermen to a sense of the danger arising from carelessly installed electric work. A by-law now receiving consideration provides that all electric wiring must conform to underwriters' standards, that electrical workers must be licensed, that plans must be submitted to the city electrician, and permits be obtained before any electrical work can be carried out, and that before the current is switched on to such new wiring the work must have been passed by the city authorities.

Miscellaneous

Fraser Falls, where the huge plant of the Canadian Western Lumber Co., Ltd., is situated, will be connected up with the New Westminster tram system in a couple of months. B.C.E.R. Co. construction gangs have commenced work on the two-mile link.

The recommendation that police call boxes should be installed throughout the municipality of South Vancouver, was recently endorsed at a meeting of the Police Committee, and Mr. Morris, wiring inspector, was instructed to report on the probable cost of the work.

City Electrician Bowler, of New Westminster, in a recent report to the Council stated that the cost of lighting the first 67 ornamental standards which have been operated one full year, was \$745.50. There are now about 3,000 light consumers, each service being metered.

Burnaby municipality, adjoining Vancouver on the east, has decided to install a police telephone system. Fifteen stations will be built at different points in the municipality, all having direct communication with head office at the Municipal Hall. Some 27 miles of wire will be strung.

Mr. Lorne A. Campbell, manager of the West Kootenay Power & Light Co., Ltd., was tendered the unanimous nomination of the Conservatives of Rossland, B.C., on March 6th, and will contest the riding at the coming provincial elections. W. R. Braden, the late member, gave his support to Mr. Campbell, who is expected to win out by a handsome majority.

British Columbia Electric Railway Company surveyors are locating the right of way for a tram line that will pass through Port Mahon, Tynehead and Port Kells, in the Fraser Valley, connecting with the present New Westminster-Chilliwack tram line at a point in Langley municipality. This line will form a loop, and will shorten the line to Chilliwack by ten or twelve miles.

Mr. R. H. Sperling, general manager of the British Columbia Electric Railway Co., recently informed the sub-committee of the Greater Vancouver transportation committee that the directors of his company in England had

decided that there would be no construction of lines in the Burnaby district until legal matters had been settled. Mr. Sperling also stated that lines in Point Grey would not be operated till legal questions had been determined.

City Electrical Engineer Thomas, of Nelson, has been instructed by the City Council to prepare estimates and prices covering an arc lamp system for the city streets similar to the one now in use in Victoria, and also on ornamental tungsten standards, so as to compare the cost of the two before deciding which will be installed. The proposed search-light installation on the top of Granite Mountain is a plan of illumination that is advocated by several citizens.

The Pacific Cable station will not be moved from Bainfield Creek, as announced recently. The C. P. R. Co. offered to provide accommodation for the cable office in Vancouver, but the London officials of the Cable Company did not consider it wise to make the transfer. The messages are sent to Australia, where they are handed over to the

Eastern Company, sent overland to the north coast, and thence via the Straits Settlement to Japan and the Orient generally.

Mr. H. E. Grant, sales agent in Vancouver for the British Columbia Electric Railway Company for several years, tendered his resignation about the middle of February and left for California, having been offered a more important position. On his way south early in March Mr. Grant attended a meeting of the National Electric Light Association of Seattle, and read a paper on the "Education of Central Station Employees."

The Fraser Lake Water & Power Co., Victoria, B.C., have given notice that they will apply for a license to use 1,000 cubic feet of water per second from the Stellaqua River in the Fort Fraser division of the Omineca water district. This river flows into the west end of Fraser Lake. The water is to be taken at a point about $5\frac{1}{4}$ miles from the mouth of the stream and to be used for power purposes.

Training Canada's Electrical Engineers

The photograph shown herewith shows the students and apprentices at present engaged in the testing department of the Canadian General Electric Co., at Peterborough, Ont. The students are graduates of various Canadian and British universities and the apprentices are chosen for the most part from Canadian Collegiate Institutes. Two years are required for the graduates' course while the apprentices

must serve four years in the testing department course. The work these men are engaged in consists of testing all the electrical apparatus as it is manufactured by the C. G. E. Co. At the expiration of the training course the men are generally transferred either to the engineering department or to the company's district offices located at various points in Canada.



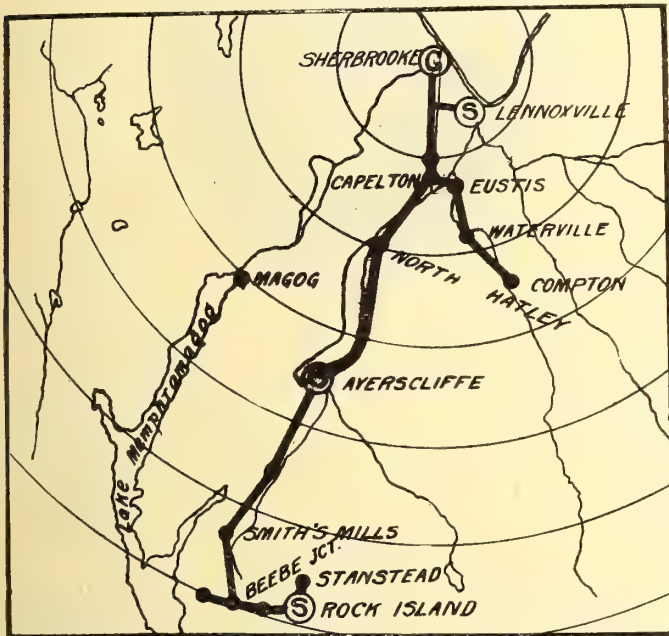
TESTING DEPARTMENT CANADIAN GENERAL ELECTRIC COMPANY, LIMITED, PETERBOROUGH, CAN., 1912

J. H. Thompson	R. W. Scott	J. H. Young	T. E. Freeman	W. J. Armstrong	W. F. McKnight	J. E. Emerson	A. F. Hanly	E. S. Shill
B. H. Johnston	A. L. Dickieson	A. H. Fielder	S. H. Butler	J. Bennett	T. E. Gilchrist	A. C. Thompson	H. K. Wyman	A. B. Gates
H. J. McTavish	S. C. MacDonald	A. T. MacLean	D. B. Fleming	G. B. Wilson	J. Lowes	W. A. Landry	T. J. Farrelly	
Charge Trans. Testing Chief Testing Dept. First Assistant								
F. D. Slipp	H. T. Laberee	J. J. O'Hearn	D. A. Jackson	J. F. Lumsden	R. B. Lees	W. L. C. Carter		

Montreal and the Eastern Provinces

Transmission Lines of Sherbrooke R. & P. Co.

As briefly stated in our last issue, the Sherbrooke Railway and Power Company have completed their new transmission line. The construction of this line and the acquisition of the Stanstead Electric Company and the North Hatley Light and Power Company gives the Sherbrooke Company control of the situation in that portion of the country for power and light purposes. The transmission line carries 22,000 volts, and is 32 miles in length. It runs southward from Sherbrooke to Stanstead, taking in Rock Island, Derby Line and Beebe Plain; it also passes through or serves by branches Lennoxville, Eustis, Capelton, Waterville, Compton, North Hatley and Ayer's Cliff.



erly, Compton, North Hatley and Ayer's Cliff. The line thus links up the entire system of the company, and will result in considerable economies, as pending its completion, power had to be purchased for supplying Stanstead and other points. Many industries along the line are now being supplied with power. Substations are located, as shown in the accompanying map, at Ayer's Cliff, Rock Island and Lennoxville. Circles on the map are 5 miles apart.

For the present no electricity will be furnished farmers along the line for lighting purposes. The larger centres will be furnished with light, and later on the farmers. The company will carry on a series of experiments for this purpose.

The Sherbrooke Council has decided to withdraw from supplying light to Lennoxville, and to leave the field to the Sherbrooke Railway and Power Company. It was stated by the chairman of the light committee that this company has been selling light at a lower rate than the city, and in view of the fact that Sherbrooke would soon require all the power generated by the council, it was deemed wise to withdraw from Lennoxville.

The Quebec Electrical Association

Members of the Electrical Association of the Province of Quebec held their monthly meeting on March 14th at the Edinburgh Cafe, Montreal—Mr. C. Thomson, president in the chair—when two or three important questions

were discussed. Mr. Hiller brought forward the subject of altering the by-laws in order to provide for associate members, and in this connection the president urged the wisdom of widening the basis of the association, in view of the possibility of another association being formed; there was not room for two societies.

After considerable discussion, a committee, consisting of the President, Messrs. Hiller, N. Simoneau, Moncel and Dietrich, was appointed to consider the question and report. Mr. Lynch was re-appointed secretary.

Mr. Sayer reported the result of an interview, by a committee, with Mr. Hadrill and Mr. Bennett, of the Canadian Fire Underwriters' Association. The questions of translating a simplified bulletin of the National Code into French, a laboratory for Canada for testing materials, and the uniformity of materials throughout Canada were discussed. Mr. Bennett gave further details of the interview, and explained the difficulties which had hitherto attended efforts to translate the code into French. Previous attempts had been very unsatisfactory. The Canadian Fire Underwriters were willing to print and distribute copies of the bulletin if the association would undertake its translation. The rules were to be simplified as far as possible, and translated in this form. Mr. Bennett also referred to the centralization of rulings relating to materials, devices, or construction. He gave instances of the differences in practice in various parts of the Dominion, pointing out that materials and devices allowed in the province of Quebec were not allowed in Ontario. No doubt a laboratory would be eventually established, but for the present they must go slow. In Canada they were handling material which would not pass in the United States; there was also a good deal of British material used and these manufacturers would not willingly submit to a further test in Canada. Under the circumstances, the association had better leave the matter alone for the present. It was agreed that a bulletin comprising a simplification of the National Code be translated into French and then submitted to the Fire Underwriters for publication.

Out of this subject arose a discussion on service wires at the point of entrance and the practice in connection therewith. It was pointed out that at present there were alternative methods opened to contractors, the use of porcelain tubes or conduits and the question at issue was as to whether the practice should be made uniform, and the Canadian Fire Underwriters asked to embody it in the simplified bulletin. It was decided that the underwriters be requested to make a rule to equip all service entrances with iron conduit and approved fittings.

The Montreal Electrical Society

On the evening of Thursday, March 14th, in the Natural History Building, Mountain street, Montreal, a meeting was held by a number of representative electricians, the object of which was the organization of a new association in the interests of this profession. There were thirty-two persons present, twenty-six of whom were enrolled as members of the organization, which it was proposed to call the Montreal Electrical Society. Mr. T. T. Davies was called to the chair, and Mr. J. C. Bray, of the Northern Electric and Manufacturing Company, Limited, was appointed secretary pro tem; Mr. W. H. Tees consented to act as treasurer until the regular elections take place. There were present representatives of the Bell Telephone Company, Allis-Chalmers-Bullock, the Montreal Tramways Company, Mont-

real Light, Heat & Power Company, the Electrical Department of the Montreal Harbor Commissioners, the Northern Electric Company, Canada Rubber Company, Mr. Philip Lahee and the Electrical Repair and Equipment Company. One representative from each of these firms was chosen to form a committee for the purpose of drawing up a circular describing the aims of the Society and to distribute the same among the electrical concerns in the city so as to give everybody interested a definite idea of the work the society intends to do. This committee will get to work immediately and it is expected that the secretary will call a general meeting at an early date to adopt a constitution. In general terms it was stated that the object of the new organization was to have technical papers prepared and read by engineers and practical journeymen; to arrange discussions on the same and to provide social enjoyment for the members.

Merger of Montreal Power Interests

By an arrangement with Mr. D. Lorne McGibbon, of the Cedar Rapids Manufacturing & Power Company, the Shawinigan Water and Power Company and the Montreal Light, Heat and Power Company have acquired substantial interests in the Cedar Rapids concern. Thus the Shawinigan and Montreal Power directors now form a controlling factor in the company, which, however, is to be carried on as an independent company. Mr. Henry Holgate is president of the board, Mr. Howard Murray and Mr. Julian C. Smith, chief engineer, represent the Shawinigan Company, and Mr. J. S. Norris and Mr. R. M. Wilson, chief engineer, represent the Montreal Light, Heat and Power Company. Mr. McGibbon still remains a director.

The arrangement now made will not interfere with the relations which have hitherto existed between the Shawinigan and the Montreal Light, Heat and Power Companies. One reason for the deal is an anticipated greater demand for power by the latter company, which would, after exhausting the supply from the Shawinigan, be in a better position to obtain what would be required.

The plans of the Cedar Rapids Company contemplate an initial development of 50,000 horse power and an ultimate capacity of 150,000 horse power.

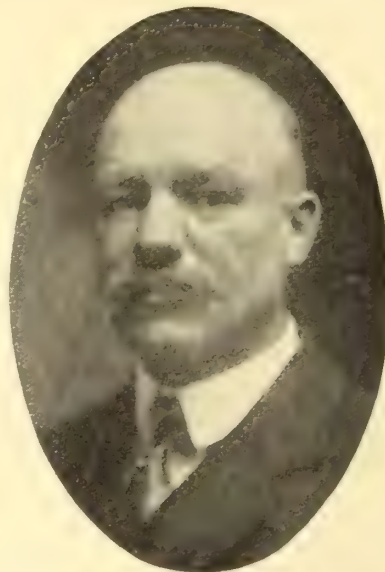
Interesting Paper on "Enclosed Fuses"

At the luncheon talk of the Electrical Association of the Province of Quebec, held in Montreal on Thursday, 7th inst., Mr. Chas. B. Ellis, Manager of the Electrical Department of The Canadian H. W. Johns-Manville Company, Limited, read a paper on "The Enclosed Fuse as a Protective Device, the Theory of Its Operation, Its Construction and Practical Application as a Protective Device." The paper was specially written by Mr. Robert C. Cole, E. E., who, for eighteen years was a pupil of, and a co-worker with, Mr. Thos. A. Edison. Mr. Cole is chief engineer of the Johns-Pratt Company, Hartford, Conn., and has devoted his time and studies exclusively, to fuse protective devices for several years past. The paper dealt with fuses from the time the first Edison fuse plug was invented, and described how the value of enclosing the fusible strip was fully appreciated, even earlier than this, as shown by the patent granted to Edison in 1880, which may be considered as the beginning of enclosed fuses. Constructional features were taken up, as well as the design of enclosed fuses, and the various metals which are known to be the best conductors, consistent with a low melting point for the carrying strip, were fully discussed. A very interesting history of the standardization of cartridge fuses, which finally took place in July, 1905, also formed part of the paper.

The Dorchester Electric Company

It is announced by Mr. H. R. Richey that the bond issue of the Dorchester Electric Company, Quebec, has been over-subscribed. The company has signed the contract with the city of Quebec for public lighting, and also secured considerable business from private interests.

On March 15th the following officers of the Dorchester Electric Company were elected in Quebec: Alderman James



Mr. James Robinson

Robinson, Montreal, president; Hon. N. Garneau, of Quebec, vice-president; directors, Messrs. W. D. Hart, Terry M. King, G. E. Tanguay, F. Gold Lyman, J. de S. Bosse and G. Proteau. It is announced officially that the company will be generating power by the middle of September.

Rejuvenation Shortly in Montreal

An effort is being made to strengthen, in the Province of Quebec, the membership of the Order of Rejuvenated Sons of Jove. This organization, with its slogan of "all together, all the time, for everything electrical," has a membership of 6000 throughout the North American continent, and is purely fraternal in its scope. In the various localities the Jovian League provides a common ground for the entire electrical trade. Mr. W. J. Doherty, the supply sales manager of the Northern Electric and Manufacturing Company, Montreal, is the "statesman" for the Province of Quebec, and has arranged for a "rejuvenation" to be shortly held in Montreal for the purpose of initiating members.

Underground Tramways Project Dropped

Owing to strenuous opposition in the Quebec Legislature, the proposal of the Montreal Council to construct and operate a system of underground tramways, coupled with a request for power to raise \$5,000,000, has been dropped. The Montreal Tramways Company, by counsel, objected to the scheme on the ground that it would interfere with their vested interests, and that it was not fair to the shareholders who had invested large sums in tramways. The defeat of the proposal involves the withdrawal of a plan to construct a line of electric railways to Lachine along the aqueduct.

Drummondville Reconstructing Power House

The Bishop Construction Company, Montreal, has been awarded the contract for the re-construction of the power-

house and for the electrical equipment at Drummondville, P.Q. The Allis-Chalmers-Bullock Company will supply the electrical machinery, and the William Hamilton Co., of Peterborough, the water-wheel. Mr. Gaspe de Beaubien, of Montreal, was the engineer for the town.

25,000 Volt Cable Under Kaministiquia River

The Canadian British Insulated Company, Ltd., Montreal, secured on March 14th from the city of Winnipeg a contract for supplying and installing their 1912 requirements for lighting and power cables. The city of Saskatoon has also awarded the company an order for supplying and installing 10 miles of three conductor paper-insulated lead covered and steel tape armoured cable. This will be laid direct into the ground for lighting purposes. Both these contracts are under a five year guarantee. Mr. R. S. Kelsch, of Montreal, has placed a repeat order with the company for a three conductor 25,000 volt submarine cable. It is intended for crossing the Kaministiquia River, Fort William, and will be the highest voltage submarine cable supplied in Canada.

Outremont to Place Wires Under Ground

The town of Outremont, P.Q., is promoting a bill in the Quebec Legislature to carry out a system of conduits for electric wires. An agreement has been reached with the Montreal Light, Heat and Power and the Bell Telephone companies, and a provision has been inserted in the bill to the effect that the town is to compensate the companies for any loss which may arise from the reconstruction of the systems, the amount to be determined by arbitration. An attempt to have this clause apply to the Montreal Street Railway and the Park and Island line failed. It is also agreed that the annual rental charge shall not exceed 5 per cent. on the cost of portions of conduit occupied by each company.

Miscellaneous

Mr. J. Bennett, chief inspector, Canadian Fire Underwriters' Association, Montreal, represented this association at the annual meeting of the electrical committee of the National Fire Protection Association, held at Boston on March 27th.

Ritchie & Ramsay, Toronto, Ont., are to install an 18 x 30-in. type "F" Corliss engine, being built by the Robb Engineering Co., Ltd. This company is also building a 16-in. x 16-in. engine and a 6 x 4 x 6-in. pump for W. S. Loggie, Chatham, N.B.

The establishment of F. Thompson & Company, electrical manufacturers, Craig street, Montreal, has been burned out, and several thousand dollars damage done. The fire originated from some hot ashes in the rear of the building. There was insurance of \$5,000.

The Grand Trunk Railway Company are installing the automatic block signalling system on the line between Toronto and Niagara Falls, which is the heaviest traffic line in Canada, and also between Hamilton and Lyndon Junction where the main lines diverge to Harrisburg and Brantford.

The Hon. L. P. Pelletier, Postmaster-General, has resigned as a director of the Quebec Railway, Light, Heat & Power Company, owing to pressure of departmental

duties at Ottawa. The vacancy on the board is filled by the appointment of Mr. Elzear Baillargeon, legal associate of the Postmaster-General.

The Glengarry and Stormont Railway Company has made application to the Ontario Legislature for the right to construct a line from the C. P. R. in Lancashire township, Glengarry County, to a point at or near the St. Lawrence River in the township of Charlottenburg and on west through the town of Cornwall. The line may be either electrically or steam operated.

At the last meeting of the Electrical Section of the Canadian Society of Civil Engineers a paper was presented on the subject of High Voltage Insulation. The paper was prepared by Mr. Gray and Mr. McNaughton, of McGill University. Professor Herdt, who presided, afterwards referred to the McGill 200,000 volt testing laboratory and briefly described the work being done there.

The Montreal Electrical Commission have written a letter to the Board of Control complaining that the Montreal Tramways Company and the Canadian Light and Power Company have not furnished information as to the amount of accommodation required in the proposed conduits. The Commissioners ask the Controllers to take action to compel the companies to give the required information.

Prof. L. A. Herdt, of McGill University, has been retained as consulting engineer to the City of Winnipeg Light and Power Department. Prof. Herdt has previously acted for the city in a consultative capacity on the Point du Bois scheme. He lately returned from a visit to Bermuda, where he went to report for the Government on the best means of improving the transportation system of the island.

Mr. M. A. Sammett, Consulting Engineer, Montreal, recently visited Amherst, N.S., where he examined and reported on the electrical plant of the Maritime Coal, Railway & Power Company. This company is generating electrical energy at the mouth of the coal pit at the Chignecto Mines, operating the local mining equipment and transmitting power for industrial and lighting purposes to Amherst, N.S., also to the Joggins Mines.

According to the statement made by Mr. J. Hutchison at the annual meeting of the West India Electric Co., held in Montreal on March 13th, gross receipts showed an increase of 9.59 per cent., and the operating expenses 20.81 per cent., on the previous year. Accident damages and legal expenses were in a great measure responsible for the large increase in the latter. The net earnings, after payment of fixed charges, were \$80,103.72, equal to 10 per cent. on the share capital, a shade under last year. The amount of \$13,589.61 has been expended on capital account.

The Public Utilities Commission of New Brunswick are meeting on March 28th to consider the rates submitted by the Moncton Tramways, Electricity and Gas Company. The rates are said to be as follows:—Gas, \$3 per thousand cu. ft., for lighting purposes, with discounts in proportion to the amount taken, and \$1.25 per thousand feet with no discount for fuel gas. Electric light, 11c. per kw.h., with discounts depending on consumption. Power, 12c. to 5¼c. per kw.h., depending on quantity consumed. Tramway charges, ordinary tickets 6 for 25c., limited hours 8 for 25c., single fare 5c.

Winnipeg and the Prairie Provinces

Electric Installation in Quarries

One of the interesting applications of electricity to industrial work which is being made in Winnipeg is the electrification of the quarries at Tyndall belonging to the Lyall Mitchell Construction Co. The initial installation will require about 600 horse power. This amount of power will be needed for running the stone cutting shop which in this instance is located at the quarry. This shop is in a building 375 feet long with a main bay 55 feet wide in which is located the cutting shop. Opening off this is the machinery floor in which there is an air compressor, four gang-saws, one single blade diamond circular saw, one two blade diamond circular saw, one rubbing bed, three single planers, one double planer, one turning lathe with 88 in. swing, and two smaller lathes for smaller stone work. All of these tools are driven by individual motors. In the main bay are three travelling cranes, one of which is of twenty-five tons capacity with a single motor for driving hoist, bridge, and traveller; one two hoist three motor crane, one hoist being of 20 tons and the other of 5 tons capacity, and the third crane is a 5 ton three motor high speed hoist. In a third bay opening off the machine floor is a machine shop 120 feet by 30 feet in which are two engine lathes, one emery grinding outfit, three forges, and one drill press all driven by individual motors. The quarries are at present served by four 75 ft. guyed mast full swing derricks driven by steam engines which will eventually be replaced by motors, and three Sullivan Z channeling machines driven by compressed air. There is at present installed a 110 kw. three phase 60 cycle 600 volt generator driven by a Laurie Corliss engine. This will be retained as an auxiliary. The 10 x 12 Bury air compressor will be motor operated.

Power has been contracted for with the Winnipeg Light and Power Department, and a substation will be erected at the transmission line five miles from the quarry where the voltage will be stepped down from 60,000 to 13,000 volts through three 300 kw. oil insulated water cooled transformers. These transformers with the 60,000 volt switches and electrolytic lightning arresters will be supplied by the Canadian General Electric Co. The three phase transmission line will be erected on wooden poles for the customer and he will supply the step down station at his premises. This will comprise three 200 kv.a. 13000/600 volt self cooled transformers and the necessary switching and protective equipment. This latter station and the motors for the electrification will be supplied by the Canadian Westinghouse Co. John Gunn & Sons, who operate a nearby quarry are also seriously considering its electrification.

Another interesting application of electricity to contracting work, but on a very much smaller scale, is that installed at the Fort Garry hotel, the fifteen storey hostelry now under construction. There are installed three 50 kw. 2200/220 volt transformers which furnish power for two 22 h.p. 220 volt General Electric slip ring motors with variable speed controller and resistance for a small range in speed variation. These are used on the two 10 ton latticed steel derricks used by the Western Steel Construction Co. in erecting the steel. There is also a 20 h.p. motor driving an air compressor for rivetting work. Power is furnished for this installation at 1 cent per kilowatt hour.

Rapid Development in Moose Jaw

Owing to the very rapid increase of business the city of Moose Jaw has found it necessary to spend the sum of

\$225,000 on extensions to the electric lighting system. These extensions will comprise one 1,500 kw. high pressure steam turbo-generator, one 500 kw. Diesel Oil Engine set, 750 h.p. water-tube boilers, coal and ash handling machinery, economizers and draft equipment, crane, new buildings, line extensions, and street lighting equipment. Specifications are now out for generator sets and line material and tenders will be called very shortly for other work and equipment. The extension work is under the supervision of J. D. Peters, Electrical Superintendent.

Edmonton Extending Equipment

The contract has been let by the city of Edmonton to the Babcock and Wilcox Co. for 4 new boilers with automatic feeders and stokers. These are to be delivered not later than June 29th of the present year. The city did not call for tenders as they had determined to maintain uniformity in their boiler plant if possible, all the boilers previously installed have been of this type. Each of the 4 new boilers will have approximately 500 h.p. capacity and the city will now have sufficient boiler capacity to operate the new generator which is just installed as well as the 1,000 kw. d.c. and 2,000 kw. a.c. generators to be installed in the near future.

Motor Generators for Winnipeg Schools

The Winnipeg Public School Board have placed an order with Siemens Bros. Dynamo Works, Ltd., for two motor-generators for the Kelvin & St. Johns Schools, Winnipeg. Each motor generator consists of a 3-phase, slip-ring type, 550 volt, 60 cycle induction motor with short circuit and brush lifting devices mounted on combined bed plate and direct-coupled to one direct current, 70 kw., 230 volt, compound wound generator, provided with commutation poles. The speed of each set is 875 r.p.m. The same company are supplying the switchboards to control the above sets along with feeders and necessary rheostats and starters, the latter of the liquid type. It is understood that one of the reasons this make of machinery was selected is that students may have an opportunity of becoming acquainted with the excellent constructive designs of the British manufactured article.

Contracts Let by City of Winnipeg

The following electrical equipment has recently been contracted for by the City of Winnipeg:—

One set of three step down transformers with capacity of 50 kw., 13000 to 2200 volts. Contract has been awarded to Messrs. Siemens Bros. Dynamo Works Ltd. for well No. 3. A similar equipment has been ordered from the same people for well No. 4.

Messrs. Allis-Chalmers-Bullock have been awarded the contract for a 150 h.p. variable speed vertical induction motor for well No. 4. This will be placed on a pump now installed.

Messrs. Stewart Machinery Co., agents for John Inglis, Toronto, have been awarded the contract for deep well pumping equipment, well No. 3. The Lancashire Dynamo & Motor Works will supply the electrical equipment for this.

The contract for the 5,000,000 gallon turbine pump equipped with 450 h.p. variable speed motor will shortly be awarded.

Lecture Before the Electric Club

The Electric Club which was organized last year in St. Boniface and Winnipeg has had a very successful winter season, some of the lectures delivered recently being the following: Resuscitation from Electric Shock, by Dr. C. E. Fortin; The Life Risk in Wiring, by F. A. Cambridge; Apparatus Troubles, by J. F. S. Madden, and a report on the meeting at Milwaukee of the Western Electrical Inspectors Association, by Mr. Swain. The present membership is 200. At the meeting on March 7th the following officers were elected: President, J. A. Douglas, Canadian Pacific Railway Co.; Vice-President, C. E. MacKenzie, Canadian General Electric Co.; Secretary-Treasurer, Joseph Turner, Jr.; Recording Secretary, W. H. Brown. The annual banquet was held at the Royal Alexandra on March 21st.

Robb Engines for Park Coal Company

Roberts & Schaeffer, Chicago, Ill., have recently placed an order with the Robb Engineering Co., Ltd., through their Calgary office, for a 16 x 16-in. Robb-Armstrong automatic engine, direct-connected to a 185 kv.a. alternating current generator, and an 11 x 12-in. engine of the same type direct-connected to a 75 kv.a. alternating current generator. These engines are to be installed at the Jasper Park Coal Co., Pocahontas, Alta., Canada, and are to be used for lighting and for motor purposes in connection with the operation of the mine.

Keewatin Power Taxes Adjusted

The disagreement between the town of Kenora and the Keewatin Power Co., over the question of taxes has been readjusted. By the original agreement the company's property was exempt from taxation for all time. The arrangement now is that the property shall be assessed at \$70,000 for the first three years and at \$145,000 for the next five years. At the end of this time new arrangements will be made.

Miscellany

Sub-station No. 1 of the city of Winnipeg Light and Power Department is now delivering power to down town consumers.

Mr. George J. Brown of Portland, Oregoon, is now with the Mitchell Gray Electric Co. as superintendent of construction.

The Winnipeg branch of the "Sons of Jove" held a rejuvenation on Friday, March 15th, when over thirty new members were initiated.

New street car barns will be erected in Edmonton on the site of the present barns which are too small for the present requirements of the city. The cost of the new buildings will be approximately \$60,000.

The Jovians held a Rejuvenation of the Sons of Jove in the Manitoba Hall March 15, at which about 40 new members were initiated. The organization is becoming a strong factor in the electrical circles of Winnipeg.

Professor Herdt has been retained by the City of Winnipeg as their consulting engineer for the light and power department. Affairs in the light and power department are moving much more smoothly under the control of acting manager Glassco. Everything points to his retention as the permanent manager of the department.

Electricity plays so important a part in the design and construction of modern buildings, that the Manitoba Association of Architects has secured Mr. J. S. Schumacher, an expert in this form of application of electricity, to lecture before them.

The Mitchell-Gray Electric Company have been awarded the contracts for the new eight-storey Sterling Bank Office Building, the 12-storey Confederation Life Office Building, and the new building for the Manitoba Free Press, all of Winnipeg, Man.

Mr. H. W. Woodman, recently of Hamilton, and who under the firm name of Woodman Bros. constructed much of the transmission line work of The Dominion Power and Transmission Co., has been appointed Operating Superintendent for the city Light and Power Department.

The municipalities adjoining Winnipeg are now anxious to have their streets lighted with electricity, contracts for street lighting in Assiniboine having been approved for award to the Winnipeg Electric Railway Co., and in Rosser to the City Light and Power Department.

Thirty car equipments have been ordered for standard cars for the Winnipeg Electric Railway for this year. These comprise G. E. 80 motors with K6 controllers, G. E. straight air brakes, and Brill trucks. The cars will be built and equipped at the company's own shops in Winnipeg.

The city of Winnipeg has awarded the contract for the transformers, switch-gear and lightning protection equipment for two pumping stations, to the Siemens Bros. Dynamo Works, Limited, Toronto. Each station will be equipped with three 13,000/2,400 volt, 50 kv.a. transformers.

Among the larger contracts for wiring installations which have been let recently are those for the Confederation Life Building, the addition to the Sterling Bank, the Free Press Building, and the new quarters for the Dominion Express Co., all of which have been awarded to the Mitchell Gray Electric Co.

The contract has been signed for the supply of power for lighting and other power uses, and the construction of an interurban line to Stonewall, by the Winnipeg Electric Railway Co. This work will be proceeded with as rapidly as possible, there being a considerable amount of work to do as Stonewall is seventeen miles from Winnipeg.

A new type of street car annunciator has been invented by Jack Watts of Elmwood. This consists of a box located at the front of the car above the door in which is a roll on which is printed in large letters, the names of the streets on a certain route. The movement of this roll is actuated by a lever pulled by the motorman as he approaches a street, the name of which appears in plain sight to the passengers within the car. The device is to be given a trial on the cars in this city.

The Electric Club of Winnipeg and St. Boniface has held several interesting meetings, one lecture being given by Mr. Fred A. Cambridge, city electrician, of Winnipeg, on the "National Electrical Code Rules and the Reasons Why"; also a talk by Mr. R. J. Swain, city electrician of St. Boniface, on the report of the Milwaukee Convention of the Western Association of Electrical Inspectors. The club held the election of officers and annual banquet on the 21st of March. The Electric Club now has over 100 members.

ELECTRIC RAILWAYS

Single-phase Operation of Small Railways at Isolated Points

There appears to be an erroneous impression abroad that the single-phase system of railway operation is suitable only for the bigger propositions. This seems to be a mistake, as is shown in more than one instance in the United States, where it has been proven that short isolated roads can be operated more efficiently and economically by the single-phase system than by direct-current. The Westinghouse Company has just published some figures of the operation of a five-mile line in New York State, and the general situation may be summed up in the following items:

(1) The road purchases its electric energy, which is transmitted 27 miles at 11,000 volts and stepped down to a trolley voltage of 2,200.

(2) No regular sub-station attendant is employed.

(3) The operating costs of the road are considerably lower than those for similar direct-current roads in adjacent territory.

(4) Nothing but an inspection shop is maintained on the property.

(5) It has not been necessary to send any equipment to the repair shop, twenty miles away, during the last eighteen months.

(6) The road seldom loses a schedule trip because of snow blockades, even when all the d.c. and steam roads in the same territory are compelled to suspend service.

The successful operation of this small isolated road, twenty-seven miles from its source of energy, establishes the important fact that, under the single-phase system, electric railways can be profitably operated in many small communities where a railway system is ordinarily considered out of the question, because of the investment involved. If a single-phase traction system is adopted the energy can be purchased at a low rate from a power company, transmitted any reasonable distance at a high voltage and stepped down to a suitable voltage by stationary transformers for the single-phase operation of the cars. Little sub-station attendance will be required. The only investment that the railway company must make is that involved in the cost of the cars, track and overhead construction.

Another interesting item in connection with single-phase motor equipment is its flexibility. The double truck cars are ordinarily too large for two motors, while four would give unnecessary capacity. With single-phase apparatus an average can be struck and three motors only used, since the motors are all connected in parallel. It is not necessary to use series parallel combinations, because any notch on a single-phase controller is an efficient running notch. There are no rheostatic losses since speed control is effected by varying the voltage impressed on the motor by connecting the motors all in parallel across different taps from the windings on auto transformers. This equipment is also economical in power consumption, because when a car is running through the thickly settled parts of the town the motormen can operate at slow speed, and on the first or second controller notches, without the waste of energy in resistance that occurs with direct current apparatus. The trolleys on these cars are of the pantagraph type and it has not been necessary to install any new shoes in the last twelve months. Small metal patches are used to repair worn shoes. The overhead line is a single-phase catenary construction.

New Car Barns for Sarnia.

The Sarnia Street Railway Company will this summer erect a new car barn and work shop at a cost of about \$10,000. The barns will be fireproof, having concrete walls with steel beams for roof with cement fireproof rolling doors and will be built in every respect according to the latest and most approved practice. Two Swedish General Electric generators are being installed in the power house of the Sarnia Gas and Electric Light Company, which supplies the street railway with power, one of 300 kw. capacity and one 150 kw. capacity. Owing to recent arbitration proceedings looking to the purchase of the latter company's plant by the town, the installation of these generators has been delayed, but we understand that the work will now go ahead immediately.

The railway company will also construct a refreshment building at Lake Huron Park and enlarge the dancing hall in the pavilion, making it one of the largest and most complete pavilions in Western Ontario. The extensions and improvements will be in charge of Mr. H. W. Mills, manager and secretary of the Sarnia Street Railway Company.

190 mile Suburban Road for British Columbia

The work of organizing, securing franchise, and otherwise preparing for the construction of an electric railway in south-western British Columbia, is being proceeded with by the International Railway & Development Co., Ltd., and bids fair to become an accomplished fact in the near future. The company proposes to construct a line from Ladner to New Westminster, and from there through White Rock to a point near Blaine, thence easterly to Huntingdon, on the U. S. boundary. It is proposed to connect the municipalities of Delta, Surrey, Matsqui, Langley and Sumas by an electric line. It is expected that eventually the line will connect with Bellingham and Seattle. The board of directors are Vancouver business men. They have planned so far for 190 miles of electric railway. The power plant will be located north-east of Vancouver some distance, and will be capable of developing 500,000 horse power. The secretary-treasurer of the company is Mr. H. T. Thrift, of Hazelmore.

New Electric Line Applies for Charter

The Burrard, Westminster Boundary Railway & Navigation Company has filed plans at Ottawa covering the construction of an electric tramway between Mission City and Vancouver. The Western Canada Power Company, which is now finding a market in Vancouver for some of the power developed at Stave river forty miles east, is promoting the scheme, Mr. McNeill, assistant general manager for that company, being named as president of the concern making application for the charter for the new line. As projected, the new railway will terminate in Vancouver at Main and Keefer streets, and its construction should prove a tremendous factor in the development of the fertile district to be traversed.

C. N. R. Will Inaugurate Gas-Electric Service

A gas-electric car service—the first of its kind in Canada—is to be inaugurated by the C.N.R. between Quebec and Lake St. Joseph. A number of cars is on order. The cars have an approximate weight of 40 tons each, are cap-

able of a speed of 50 miles an hour, and have a seating capacity of 60 passengers. The cars are to be constructed of steel and are to have electric lights. The power is derived from a gasoline engine, and is transmitted to the wheels by means of an electric drive. The engine is directly coupled to an electric generator, applied to standard railway motors, mounted on the axles. The car is operated by means of a controller similar to ordinary electric cars. There are three sections in each car, baggage, smoker and ordinary compartment. Similar cars are in use on the Bangor and Aroostock Railway, in the northern part of Maine, and by the Delaware and Hudson company.

M. & S. C. Makes Liberal Offer

The Montreal and Southern Counties Railway Company have made another attempt to obtain the use of certain streets in order to get admittance to the shopping district. Mr. Powell, the manager, has presented a petition to the Board of Control pointing out the importance of the company securing this entrance, in view of their projected extensions. The company have offered to pave the streets affected by the route from curb to curb, provided that their cars are allowed to run. The controllers, however, have decided that the questions between the Montreal Tramways Company and the city will have to be settled before any final decision can be made with regard to the Southern Counties' proposals. The plans of the company for its extension to Granby have been approved by a committee of the council of Granby, and the company have also received petitions from Pauline and Abbotsford asking that branches be constructed from the main line to those towns.

Brill Co. Building 25 Cars for B. C. E. R.

The new complement of 25 cars which the B. C. Electric Railway Co. is adding to its equipment in Vancouver, are being manufactured by the Brill Co. of Philadelphia. Twelve of these cars have already arrived, and the balance will be here shortly. The cars are double-enders of the pay-as-you-enter type, and sanitation and ventilation are two points that have received considerable attention in their construction. They provide seating capacity for 48 passengers. The roof is of arch type, this form being designed to give better ventilation. The ventilators are placed in the roof of the car, and are eight in number. These cars have slat seats, it having been decided that this type is more sanitary than the cane seats. These seats also admit of the thorough cleaning of the cars with hose and water.

Regina Returns for January

Operating returns for the month of January for the Regina Street Railway System were as follows: Gross earnings \$5,424, operating expenses \$4,345, net \$1,079. The car mileage amounted to 20,283; the gross earnings per car mile were 26.7c.; net earnings per car mile 5.3c.; total number of passengers carried 114,067. The gross earnings were made up as follows: Cash fares \$1725.00, ticket sales \$3,414.00, special cars \$15; advertising in cars \$270.00.

Must Not Use Salt

The Montreal Board of Control have notified The Tramways Company to discontinue the use of salt on their tracks, owing to the danger to vehicular traffic and its unpleasantness to the public. The company have replied, contending that they are justified in its use under a by-law of the city. At the same time the company are willing to substitute any other material selected by the city which will be found satisfactory.

Miscellaneous

Mr. B. J. Arnold has been appointed consulting electrical engineer for the Montreal and Southern Counties Railway extensions.

The Dunnville, Wellandport and Beamsville Electric Co. has been granted a 2-year extension of the time required for the completion of its road.

Application is being made by the corporation of the town of North Bay for an act authorizing the town to construct and operate a line of railway in the town of North Bay and connecting the town with Trout Mills, Sturgeon Falls and Callander.

The Regina Street Railway System will add to its rolling stock in the near future, six new cars. These are being supplied by the Preston Car and Coach Company, of Preston, Ont. The electric equipment will be Westinghouse 101 B2 motors and the trucks the Curtis manufacture.

The Ontario Legislature has granted a charter to the Humber Valley Railway Company. It is proposed to construct this road along the Humber Valley from Lambton south to Lake Ontario and thence east to Sunnyside. The road will open up a fine suburban residential district for Toronto.

The President of the Montreal Tramways Company has promised to give an improved service providing the city will give consent to new routes. The company are also anxious to have a new contract with the city, but for the present they desire permission to give the public additional facilities.

Application is being made to the Ontario Legislature to change the name of the Monarch Radial Electric Company to the Toronto and Barrie Radial Railway Company. It is stated that the chief obstacle in the way of the construction of this road is the difficulty in obtaining an entrance to Toronto.

It is understood that Sir Wm. Mackenzie interests will early in the spring commence construction on a road connecting Toronto with Guelph passing through Cooksville, Brampton, Georgetown, Acton, Eden Mills. In the near future it is planned to radiate lines from Guelph to Galt, Berlin and other points.

A deputation recently waited on president Todd, of the Galt, Preston & Hespeler Electric Railway system with the request that this company extend its electric road northward from Waterloo to Elmira, in exchange for which they would be given a 25-year franchise and running rights over the Berlin and Waterloo lines.

The Kawartha Transportation Company has been granted a charter with power to construct and operate an electric line, with Peterborough as the central point. Branches will connect with Clear Lake, Rice Lake and Chemong. The company must commence operations on the section between Peterborough and Clear Lake not later than September 1st, 1913.

A bill is being introduced in the Nova Scotia Legislature to force the Halifax Electric Tramway to give the city conditions different from those required by its charter. The city claims that the company is making too large a profit, and though the franchise agreement is apparently clear in its intent, the city is asking the Legislature to annul the said agreement.

CANADIAN TELEPHONES

Telephone Statistics of Canada

The statistical section of the Department of Railways and Canals, Ottawa, has just issued the first report of its kind dealing with the extent and character of telephone operations in the Dominion. The object was to obtain information which would fairly and comprehensively show the facts with regard to organization, capital invested, operating income, operating expenses, equipment, tolls, and employees.

It is pointed out that complete information has not been obtained. On account of this being the first attempt to classify telephone information in Canada more than average difficulty was met with in obtaining the information sought for. Many of the companies are so small and have so little system in connection with their operations that the questions asked by the government could not be answered at all. The report does not claim to be complete, though it is evident from the figures given that it cannot be so very far from the facts. The total number of telephone organizations, which includes companies of all kinds, is given as 537. Of these, Ontario contributes 319, Quebec 32, New Brunswick 16, Nova Scotia 14, Alberta 4, Saskatchewan 143, Manitoba 3, British Columbia 5, Prince Edward Island 1. The discrepancy is doubtless greater in Ontario than in any other province where there are now actually about 450 independent companies operating.

It is pointed out that the three provinces of Manitoba, Alberta and Saskatchewan have, through their governments, to a greater or less degree taken over the telephone interests. In Alberta and Manitoba, practically all the separate companies which existed a few years ago have been merged under government control. In Saskatchewan the process of absorption is under way, but there remained on June 30th, 1911, still 142 companies operating on an independent basis.

Under the heading "Capital and Cost," the total liabilities reported amount to a little over \$40,000,000. The total number of telephones in use is 302,759, which works out to a little more than \$132 per telephone.

The gross earnings of all the Canadian companies reported, amounted to a little over \$10,000,000; operating expenses almost \$7,000,000, leaving net earnings of slightly over \$3,000,000. These gross earnings average \$33.25 per telephone or \$14.64 per mile of wire. Operating expenses averaged \$23.05 per telephone or \$10.15 per mile of wire. The equipment of all the companies' lines includes 687,728 miles of wire; of this, 576,712 is urban, and 111,015 rural. The long distance wire mileage is reported as 94,750. Of the total of 302,759 telephones in use, 174,994 are operated by central energy and 127,765 by magneto.

The total number of employees reported was 10,425, who received \$915,636 per year. This amount equals 13.1 per cent. of the total operating expense, which would seem to indicate that the proportion of labor involved in the cost of operating a telephone system is relatively low. It is pointed out, however, that many of the rural organizations do not employ either operators or repairers, the connections being made often by some person who received therefor the free use of a telephone.

The report prints the data received from the 537 companies, giving for each the head office address, capital stock, funded debt, property and equipment cost, revenue, operating expenses, equipment, wires (whether galvanized or copper and whether overhead, underground or sub-marine) the

number of telephones of each type, and the number of employees with their remuneration.

Summing up, the report concludes "That returns were received from 537 distinct telephone organizations must be regarded as encouraging, in view of the many obstacles which had to be overcome in gathering data for this first report. The notice to reporting officers was insufficient and there was not time enough for the carrying on of complete explanatory correspondence. The work done, however, has been educational in character and has undoubtedly paved the way for smoothness and a larger measure of success in future."

The Maritime Telegraph & Telephone Company

In June of last year the shareholders of the Nova Scotia Telephone Company sold their entire system to the Maritime Telegraph & Telephone Company, who now control absolutely all the independent telephone companies operating in Nova Scotia and Prince Edward Island, which are deemed by its directors to have any value for revenue purposes. The companies that have been absorbed also include the Antigonish and Sherbrooke Telephone Company, the Queen's County Telephone Company, the Prince Edward Island Telephone Company, the Cape Breton Telephone Company, the Annapolis Valley Telephone Company, and the Yarmouth Amalgamated Telephone Company.

The Maritime Company also holds a 99 year lease of the sub-marine copper wire cable connecting Prince Edward Island with the Nova Scotia telephone lines. Also, a private telegraph system connecting Halifax, Sydney, and Charlottetown has been established and leased on profitable terms to E. and C. Randolph. These properties taken together include the following:—15,000 telephones, 3,500 miles of poles, 33,000 miles of wire and twenty office buildings. The value of the real estate, building and plant equipment, securities of other companies, etc., totals more than \$2,600,000. The plant and equipment is of up-to-date design and great care is being taken in maintaining the utmost efficiency.

A booklet has just been issued by F. B. McCurdy & Company, investment bankers, Montreal, calling attention to the value of telephone and telegraph stocks in general and the Maritime Telephone & Telegraph stock in particular as a conservative investment. In support of this argument they quote the fact that the earnings of public utility or public service corporations such as telegraph and telephone companies are not affected by adverse trade conditions, and state that this was evidenced in the great panic of 1907, and the depression of the following years. It is shown that while the earnings of railway and industrial companies indicated a marked falling off, the Nova Scotia Telephone Company showed an increase of \$16,000 in earnings.

Another statement of interest is made in this booklet somewhat at variance with the statements we are apt to hear when telephone companies want to increase their rates to consumers. The item reads:—"Usually the larger the business of a concern grows, the cheaper it can conduct its operations. This is particularly true of telephone companies." It is doubtful, however, if this is a fact except in the mind of an enthusiastic stock broker. It is true that in certain cases where the system extends over a large area and it is necessary to install trunk lines connecting a number of cities, towns and villages, the completion of

these feeders would open the way to a considerable addition to business and increased service under these conditions might not mean increased cost of operation in the same ratio. In cities of any considerable size, however, it seems to be a recognized fact that the larger the number of telephones in use the greater the cost of operating each individual telephone. From the consumer's view point it is a reasonable conclusion also, for a service that puts him in communication with 100,000 people on his telephone should be worth more to him than a service which puts him in communication with only 10,000.

There is more truth, we believe, in another statement in this little book referring to the question of whether telephone service is better under a monopoly or under a number of competing systems. The article says, "when the telephone business was young the public regarded a second or third telephone system in one district as quite possible and desirable. This went on merrily for years before it was discovered that the telephone is not an ear but a nerve system; and a duplicate nerve system has never been attempted by nature even in her most frivolous moods. People fancied that to have two or more telephone companies was the same as having two competing railway lines or gas companies. They did not, for years, discover that two telephone companies in one city means either half service or double cost. To be served by one line when other people with whom you do business are on another line is, to say the least, most unsatisfactory." We believe this sentiment expresses the views of most telephone users at the

present time. There are other ways and better ways of establishing a good telephone service in any city or town than by installing a competing system.

A Good Annual Report

The annual meeting of the Crystal City Branch of the Louise Telephone System was held on Friday, March 1st. The treasurer's report showed a balance of \$150 with no liabilities, as against a debt of \$370 a year ago. In addition to this the yearly assessment per member has been reduced from \$10 to \$8. For the coming year this will be further reduced to \$7. The officers for the coming year were elected as follows:—J. E. Parr, president; J. F. Mutch, secretary-treasurer; W. H. McKittrick, manager.

A Growing Concern

The First Annual Sales Conference of the Northern Electric and Manufacturing Company, Limited, was held February 26, 27, 28 and 29th in the Prince George Hotel Committee Rooms. The photograph herewith shows what great strides have been made by this company. They were honored with the presence of several representatives of leading manufacturers in the electrical line and a great stimulus should result from such an enthusiastic gathering. Mr. J. F. Ward, district sales manager, was chairman of the conference. Papers were read by different members of the sales departments and a banquet was held on the evening of the 28th, followed by a theatre party.



FIRST ANNUAL SALES CONFERENCE, THE NORTHERN ELECTRIC AND MFG. CO., LTD. (Toronto Branch)
PRINCE GEORGE HOTEL, FEBRUARY 26-27-28-29, 1912

J. F. Little	J. J. Whelan	H. F. Strickland	R. Driscoll	J. Lyle	F. Stevenson		
P. A. McFarland	R. McK. Inglis	E. J. Lloyd	P. M. Chamberlain	F. V. Burton	F. E. Ritchie	C. L. Gulley	R. R. Roberts
G. P. Cairns	W. S. Ewens	B. L. Bauleh	J. A. Daly	C. A. Howe	G. L. Patterson	P. C. Chrysler	E. B. Milloy
H. F. MacGuyer	L. J. Mattice	B. H. Scranton	K. J. Dunstan	M. R. Roeder	H. D. Betts	J. F. Ward, (Chairman)	W. J. Doherty
W. G. Graham	H. P. Young	C. H. Dudley	G. C. Knott	G. T. Hall	J. A. McDonald		

Bell Added 20,048 Subscribers in 1911

Although the Bell Telephone Company added 20,048 subscribers last year, the net revenue showed a decrease of \$121,290, due to increasing operating expenses. The gross earnings were the largest in the history of the company, \$6,476,848, a gain of \$1,400,000, while the net was \$1,425,835, the expenses having gone up from \$3,963,559 to \$5,051,012. After setting aside a million dollars for dividends, there remained a surplus of \$425,835, making the total balance to revenue account \$530,415. From this the sum of \$410,000 was distributed amongst pension, contingent, accident, insurance, patent, building and other accounts, leaving a surplus to be carried forward of \$120,415.

With regard to the company's property, the report for last year showed that they now had 153,959 instruments earning rental. These were handled by 470 exchanges and 1,466 agencies. For their long distance service the company operated 58,300 miles of wire, strung on 9,038 miles of poles. This meant an increase of 4,167 miles of long distance wires during the year. In addition nine buildings had been added to the company's equipment. The company has arrangements for interchange of business with 433 independent companies, serving 44,570 subscribers, or about one-fourth as many instruments as the Bell company operates. The real estate owned by the company was put in at \$2,208,865. At the annual meeting held in Montreal, the Board was re-elected as follows: C. F. Sise, president; Hon. Robert MacKay, vice-president; Theo. N. Vail, Robert Archer, Wm. R. Driver, Hugh Paton, Charles Cassils, H. B. Thayer, L. B. McFarlane, Z. A. Lash, K.C., directors.

B. C. Amends Rural Telephone Act

At the recent session of the British Columbia Legislature an act called the Rural Telephone Act was passed which removes many of the difficulties which have hitherto prevented municipalities and others from constructing and operating small rural telephone systems. By the present act any five or more persons may form a limited liability company for the purpose of constructing and operating rural telephones. The capital shall not exceed \$150 for every pole mile of line. Existing companies must make connections with new companies, unless the expense is too great, in which case the matter is at the discretion of the Minister of Public Works. All rates must be approved of by the Minister and dividends are not to exceed eight per cent., any balance of profits being devoted to improving or extending the system or reducing the rates.

Total Cost Only \$67.54 Each

The first annual meeting of the Harvey Telephone Company was held in Lakehurst on March 4th. This line has now twenty-four subscribers, eighteen of whom were present. The total cost of construction with interest to date amounts to \$67.54 each. This amount having been paid, the subscribers own their own line and telephone and the only future cost will be that of maintenance which is comparatively small, probably in the neighborhood of \$2 a year. Arrangements have been made for connections with the Bell long distance system.

Doubled Number of Subscribers in 1911

The third annual meeting of the Megantic People's Telephone Company was held in Inverness, Quebec, on March 2nd. The president, Mr. D. H. Pennington, M.P.P., presided. The report presented showed the company to be in a very progressive way, the number of telephones added

during the year being 262, bringing the present total up to 484. Two important centrals have been established at Plessisville and Robertsonville. \$10,000 worth of stock will be sold to enable the company to build further lines and install more telephones.

New Saskatchewan Companies Incorporated

The following telephone companies have been incorporated under the act respecting Rural Telephone Systems in the Province of Saskatchewan:—Ferndale Rural Telephone Company; The Watrous Rural Telephone Company; The Whitewood, St. Hubert Rural Telephone Company; The Semans Rural Telephone Company; The Bloomenfeldt Rural Telephone Company; The Park Rural Telephone Co.

Edmonton Wants Whole System

The twin cities of Edmonton and Strathcona are now incorporated together as the city of Edmonton. The telephone system in Strathcona is owned by the government of Alberta while the system in Edmonton is owned and operated by the city. Negotiations are in progress looking to the purchase of the Strathcona end of the system by the city, in order that the whole telephone plant of Greater Edmonton may be under the one head.

Blenheim & South Kent Annual

The report of the annual meeting of the Blenheim and South Kent Telephone Co. showed the company to be a prosperous condition. The area covered is about 25 square miles around Blenheim, the total number of subscribers being about 540. The officers of the company are T. L. Pardo, president; A. Denholm, vice-president and general manager; Geo. Taylor, secretary-treasurer; W. E. Hall, G. W. Mallory, G. J. Gibb, Wm. Saddington.

Bruce Telephone Co. Will Extend

The Bruce Telephone Company have decided to extend lines to Kincardine, Port Elgin and Paisley. The town council of Kincardine has granted them permission to erect poles along the streets of the town. An agreement may be made with the Bell Telephone Company, to utilize a common central office in Kincardine or an independent central may be established.

Miscellaneous

The Ivy-Thornton Telephone Co. are making arrangements to connect with the Bell Co., at Barrie.

The Coquitlam Telephone Co., Ltd., has been incorporated with a capital of \$50,000, head office Vancouver.

The Bell Telephone Company are erecting poles and cable and reorganizing the Kincardine system, at a cost of about \$5,000.

Owing to alleged unsatisfactory conditions in the telephone system in Fort Frances, Ontario, steps are being taken to prepare plans for a municipal system.

Alexander Graham Bell, the inventor of the telephone in 1876-7, celebrated his 65th birthday on March 6th. Professor Bell was born in Edinburgh, Scotland, but at the time of his telephone invention lived in Brantford, Ontario.

By an amendment to the Ontario Telephone Act being dealt with by the Legislature at the present session, power

is being given municipalities to expropriate any telephone system or systems within the borders of the municipality.

It is reported the Bell Telephone Company will erect a new exchange building in Paris, Ont.

The Oro Telephone Co. has not had a satisfactory year, it being understood that they are \$1,400 behind on the year's operations. It was decided to raise the annual rental to \$5 per telephone.

Summerland Telephone Company Limited has been incorporated with a capital of \$50,000 to construct and operate telephone lines in the County of Yale with head office at Summerland, B.C.

A new telephone exchange, "La Salle," has been opened in Maisonneuve, Montreal. It serves the east end of the city, and a portion of the names under the designation "East" have been transferred to "La Salle."

A large public meeting in South Vancouver recently assembled for the purpose of listening to an address on the subject of Government Ownership of Telephones passed a resolution favoring such a system.

Mr. William Farrell, president of the B. C. Telephone Company, is at present in England placing the order for the new cable to be laid between Victoria and Vancouver via Nanaimo, which will represent an expenditure of about \$150,000.

The C.P.R. have already placed orders for the construction of new telephone lines in the west to the extent of 450 miles. This, in addition to some 250 miles of line work not completed last year will bring the present year's extensions up to 700 miles of new line.

Tenders are called for the installation of a system of Police telephones for Burnaby municipality, B.C. This is on the recommendation of Chief of Police Parkinson, who stated that the installation of such a system would be equivalent to an addition of three men to his staff.

The advance in telephone rates in Winnipeg is not likely to be enforced on the first of April as was originally intended. The Commission appointed to investigate the operations of the telephone department have advised against putting these new rates into effect before their investigation is completed.

When the wiring between Vancouver and Kamloops is completed, all C. P. R. trains between Vancouver and Winnipeg will be routed by means of telephones. As the Electrical News has already explained, the C. P. R. is replacing the telegraphic dispatching systems on large sections of its system with telephones.

A telephone bill has been introduced into the Legislature by the Hon. I. B. Lucas, which provides among other things for an interchange of communication between the different independent systems. By this bill, also, municipalities are prevented from granting an exclusive franchise to any telephone system, without first submitting the question to a vote of the people.

Mine Telephones—Their Elaborate Construction and Efficient Operation—Air and Moisture Proof

By Mr. W. C. Freeman

Nearly every well informed person connected with the telephone and mining industries, has either seen or heard of mine telephone systems, but few have ever considered what an elaborate piece of apparatus a mine telephone is.

In the familiar type of telephone for use on surface systems, the manufacturers are required to produce an assembly of all essential operating parts in a compact, durable and attractive cabinet, which shall successfully re-

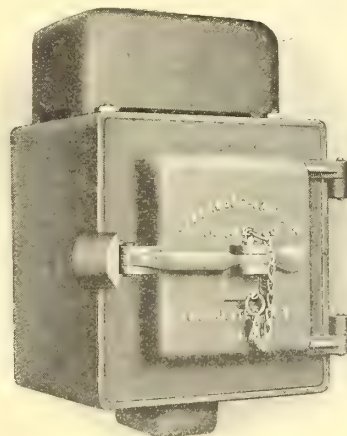


Fig. 1

ceive and transmit speech and the necessary signals. In the design of telephones for mining and other subterranean service, the apparatus must fulfil the above requirements and in addition be built to withstand the action of the severe

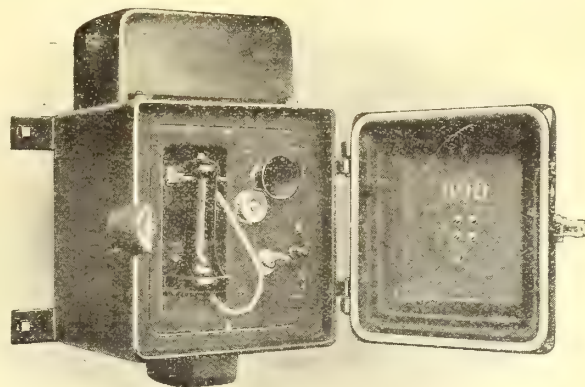


Fig. 2

conditions briefly summarized as follows:—mechanical injury, action of corrosive acids and gases, action of excessive moisture.

Mechanical injuries may result from falling masses of rock, explosions, careless handling of tools, and many other causes. The first illustration, Fig. 1, will give a good general idea of the extent to which provision against such injuries must be carried. It will be noticed that none of the operating parts are exposed. The housing of the instrument consists of a heavy well finished casting, the thickness of the walls varying between three sixteenths of an inch on the plane surfaces, and three eighths of an inch on the edges and corners. All parts subject to any unusual strains are strongly reinforced.

While the effects of water and of corrosive acid solutions and gases are different in nature, the arrangement of the protective features are much the same. The materials

employed, however, must be selected with the greatest care. To protect the casing against corrosion from acids and the formation of rust, a tough and somewhat elastic enamel is used. The exact nature of this enamel has not been made public, but it seems to "fill the bill." By referring to Figs. 2 and 3, it will be noted that double doors are provided for access to the interior of the instrument, since it is quite necessary that all parts, except those handled by the

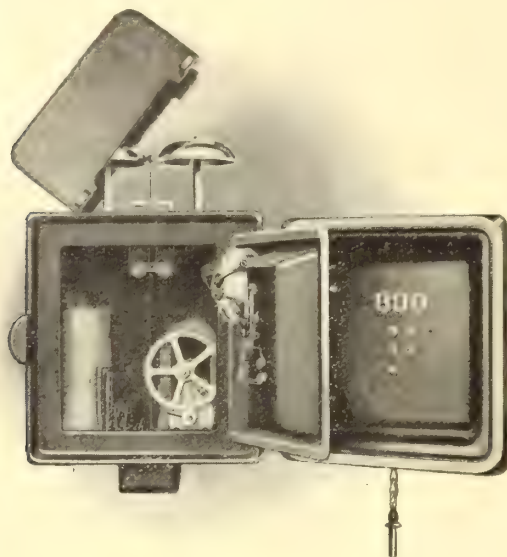


Fig. 3

user, be kept under cover even while the telephone is being used. As a precaution against the penetration of water, gases, and dust, the inner periphery of the front door is provided with a tubular gasket, which, under the pressure of the latch lever effectively seals the telephone. When this outer door is opened for service, the only parts exposed are the receiver with its cord, the generator crank handle, and the little cord take-up device, which prevents the possibility of the cord being jammed between the door and the case.

The secondary measures of protection embodied in this type of telephone are particularly interesting. The inner door is also gasketed with felt and the generator crank shaft guided through the door in a stuffing box which is practically air tight. The handling of the ringer movement so as to require no opening in the inner case is clever. Instead of employing the standard relation of ringer, coil, pole pieces and armature with the clapper rod doubling back, the armature carries the gong striker on its upper face, which avoids the necessity of an opening, since the pole pieces are brought up through the casting snugly and water tight. The armature and clapper rod, together with the gongs, are mounted under the dome shaped hood while the ringer coils lie within the sealed inner compartment.

Notwithstanding the fact that the inner chamber of the telephone is air and water-tight, the manufacturers have impregnated all coils with a water proof insulating compound, which is thoroughly baked into the windings by a vacuum process. All of the component parts of the various pieces of apparatus are given a finish of some kind, preferably of zinc or copper, to avoid the possibility of corrosion. It was indeed a problem to successfully design a mine telephone which would stand abuse and severe atmospheric conditions and at the same time, faithfully perform its duty.

Intercommunicating and Extension Telephones

In accord with the Kellogg Switchboard and Supply Company's usual methods of assisting customers, not only

with practical engineering information but with advertising assistance, this company is distributing free to customers two very attractive postal cards that can be used by the operating companies in their campaigns for subscribers and special service. These cards, printed in two colors illustrate and describe, in a way appealing to the subscriber, the advantage and economy of extension sets in homes or offices and automatic push button intercommunicating systems for residences, offices, factories and warehouses.

On the stamp side of the card is the usual blank space for address in which the operating company can place their own address, making it a return card, which is enclosed in the regular correspondence to subscribers or with a personal letter to special lists of people most apt to be interested in either service. The space for the message on this side of the card is printed as follows: "Gentlemen: Kindly advise me as to the cost of an extension telephone per this card." Then follows space for subscriber's name and address. The Intercommunicating System return card is similar except that the message reads as follows: "Gentlemen: Kindly advise me as to cost of a private telephone system per this card."

New Stromberg-Carlson Test Set

The accompanying illustration shows a new lineman's test set recently placed on the market by the Stromberg-Carlson Telephone Manufacturing Company of 72 Victoria street, Toronto. This test set is a complete local battery telephone fitted with equipment comprising flush type transmitter and watch case type receiver having weatherproof linen covered stranded copper cord, induction coil and three bar generator. The cabinet is strongly built of quarter sawed oak and has a durable finish. The carrying strap has snap fasteners and a longer shoulder strap can be furnished if ordered special. The buzzer wound to 100 ohm resistance and wired in series with generator may be rung when receiver is in position on top of case. A push button placed in top of case, which acts as a hook-switch when receiver is removed, cuts in the battery and cuts out the buzzer.



It is reported that the London and Lake Erie Transportation Company has signed a contract with the Hydroelectric Commission for 500, or more, h.p. at \$28.00 per h.p. year, and that \$12,000 will be spent on new railway equipment.

The Manitoba Power Company is reported to have arrived at some kind of a working arrangement with the Winnipeg Electric Railway Company and allied interests, as a result of which an inventory is being taken of the property with a view to definitely fixing the purchase price.

It is reported that Congressman Difenderfer has asked the following question, "Did the Niagara Water Power Companies exert undue influence in the compilation of the hearing held before the committee on the advisability of diverting more water from the Falls than is at present diverted?" Mr. Difenderfer claims to have information that certain power interests paid for the compilation of the record, including the indexing, and that it was made under their supervision.

Electric Vehicles in City Work — Specially Adapted for Light Delivery—Storage Batteries Now Reliable

The last two or three years has witnessed a great increase in the popularity of gasoline engine motor cars for all types of delivery, as well as light passenger work, in the city. It has been shown that more work can be done in the same time with a smaller staff of men and at less expense. A close competitor in this type of work is the storage battery vehicle, and the comparison seems to favor the electric drive for light delivery work, even at the present stage of development. In large cities, with the constant starting and stopping, the inflexibility of the gasoline engine makes it a difficult matter to design heavy vehicles which will withstand the continual strain, and in addition the energy consumed while the vehicle is standing or accelerating its speed is often considerably more than that required to get from one stop to another. This necessitates a larger engine than would be required to drive the vehicle at a regular speed, and such an engine when running at high speed and developing low power means inefficient operation. Other factors attendant on these conditions, due to the inherent quality of the engine add to the inefficiency.

The remedy will ultimately lie in the adoption of storage batteries as the source of power, at least for the lighter form of delivery vehicle and probably for all types. The reason which may be advanced in favor of this are:—(1) The absence of shock and vibration. (2) The low rates which can be obtained from the supply station since the current may be taken at off-peak hours. (3) The instant readiness of the vehicle and its lower depreciation charges. (4) The fact that the vehicle, while stationary is not absorbing power reduces, as noted above, the consumption cost often by fifty per cent and upwards.

The chief reason why electric vehicles have not made more headway up to the present time probably lies in the fact that the storage batteries have not proved satisfactory. To begin with it is difficult to obtain a battery large enough to supply sufficient power without unduly raising the weight of the vehicle. Further, batteries are not fool-proof and inexperienced and careless drivers have done much to shorten the lives of the batteries under their care either by careless charge or discharge. Certain types of electric vehicles have been manufactured with the regenerative feature, meaning that whenever the vehicle slows down or passes down a decline the batteries are re-charged. In electric traction or electric bus work this is found to work out very satisfactorily, lowering the cost of charging materially and lengthening the life of the batteries, in that way they are kept more nearly at a full charge for a greater length of time. It is doubtful however, if this feature can be introduced in the city delivery buses where stops and starts are so frequent and where the length of time the cells would be charging would be almost infinitely small under ordinary conditions. The plan however, has been used in England and is favored there.

Comparative costs of operation per bus mile of an electric and a gasoline omnibus in London, England, have just been given in a paper presented before the Institute of Electrical Engineers by J. C. Macfarlane and H. Burge. In pence per bus mile the electrical vehicle is calculated to cost 3.6, the gasoline vehicle 4.7. This includes battery maintenance, power, oil, lighting, insurance, washing, and all depreciation. The energy consumption was placed at 88 watt-hours per ton mile. The average horse-power required to drive a bus at a speed of $12\frac{3}{4}$ miles per hour was $8\frac{1}{2}$ horse-power.

Summing up the advantages of the electric vehicle over the gasoline the article gives the following items:—

(1) The vehicle can be immediately started or stopped. (2) The control is fool-proof throughout having only one pedal to operate while driving. (3) Braking is carried out by means of the pedal. (4) Full power will develop under any conditions of weather. (5) No noise, smell or filth. (6) Starting up is a uniform acceleration and without shock. (7) There is no vibration, due to reciprocating parts. (8) There is no jar, due to clutching, while running up, changing speed or braking when stopping.

In this connection it is interesting to note that a new car manufactured entirely in Canada, which appears to fulfil all these conditions, has recently been placed on the market in Toronto. Further special features of this car commend

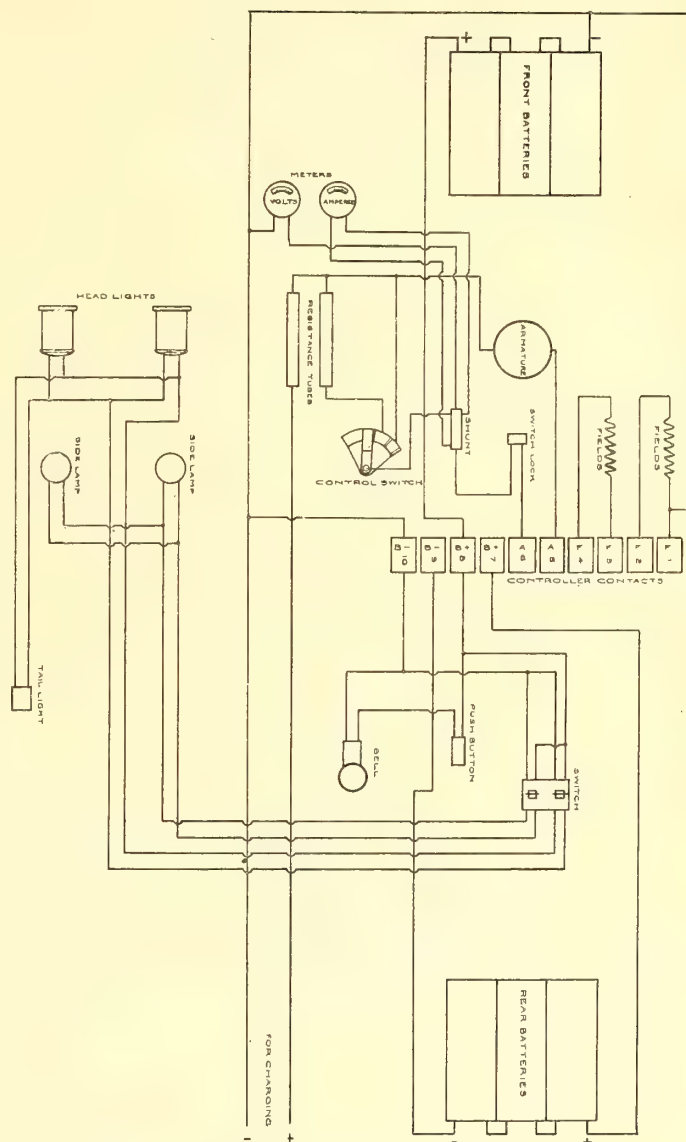


Fig. 1—Wiring Diagram of Peck Electric Car

it as likely to hold a prominent place in the field of motor vehicles. The application of the series parallel motor used not only insures reliability but the rugged construction permissible with this type of machine means a longer life and less time spent in the repair shop. One criticism has been made that the sudden inrush of current when starting with heavy loads or on grades would tend to strain the transmission between the motor and load wheels. This might be true if the old method of control were used which built up the torque through intermediate steps but in the car to which we refer a new system of control has been adopted which absolutely insures the flow of current to be continuous from zero to maximum load without any intermediate

steps. This not only gives greater mileage per charge but lengthens the total life of the battery. The car is equipped with a lead battery of 42 cells, each having 15 plates. An advantage which does not seem to have been recognized heretofore in electrical vehicle work is that 42 cells can be charged on a 110 volt circuit more economically than

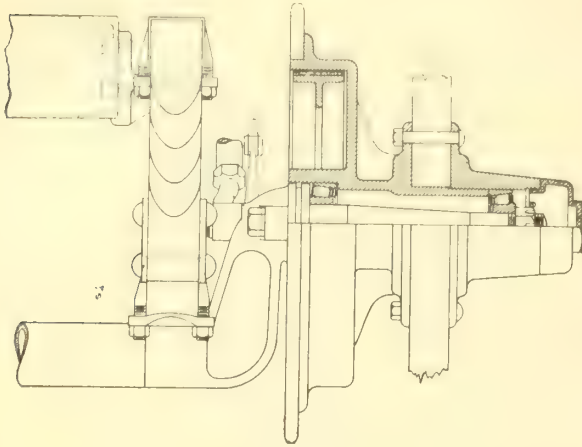


Fig. 2—Showing Drop Axle of Peck Car

a smaller or greater number. Where a greater number is used, the cells are not fully charged. Where a smaller number is used either the cells are over-charged or a certain amount of energy is wasted, by radiation. This battery will drive a light delivery car with a load capacity of 1,000 lbs., a distance of from 30 to 50 miles on one charge. Mechanically the construction of this car looks to be of the best. A feature worthy of note is the drop axle, shown in one of the accompanying cuts. This allows the load to set lower and carry easier. Another feature is the adjustable mast. By simply pressing a button on the floor with your foot it is possible to place the starting wheel in any posi-



Fig. 3—Adjustable Mast of Peck Car

tion most convenient to the driver. This movement is not in steps but is continuous and the mast can be locked securely in any position whatever. The car is manufactured by the Peck Electric Co., of Toronto. The larger line cut shown herewith represents the wiring diagram of the Peck car.

Montreal Tramways Bill Passes

During the past month the affairs of the Montreal Tramways Company have been keenly discussed. The company presented its bill, of 354 pages, to the Quebec Legislature asking for the ratification of the agreement with the Montreal Street Railway Company, the Montreal Park and Island Railway Company, and other subsidiaries, and for exempting from the authority of the Public Utilities Commission the question of the acquisition of the shares of any

other company. The city council threatened very strong opposition, but the company made concessions before the Legislation Committee, and counsel for the city expressed himself as satisfied. The company withdrew the clause which gave power to acquire shares of any company without the approbation of the Public Utilities Commission, and also accepted an amendment to another clause, by which the rights of the city are safeguarded with reference to its by-laws affecting the company and the contracts which exist between the city and the company. The city desired to guard the right to grant the company a further franchise. A subsequent effort was made to postpone the bill on the ground of over-capitalization, but this was lost, and the measure passed.

The Montreal Tramways Company have ordered 65 new cars, making 100 since the beginning of the year. These are being manufactured by the Canada Car Company. The Tramways Company have now all their cars fitted with emergency brakes, and are gradually substituting cars of the double truck type, in place of the single type, all being fitted with air brakes. The Public Utilities Commission recommended the abolition of the single trucks.

The Chamberlain & Hookham Meter Company

Mr. Stanley L. B. Lines, president of the Chamberlain & Hookham Meter Company, Limited, comes to Canada after a varied career in the numerous phases of electrical work. He received his training in the electrical engineering department of the British Thompson Houston Company, Limited, the sister firm of the Canadian General Electric Company, Limited. Mr. Lines became connected with electrical meter manufacturing some twelve years ago, and in the meantime has travelled in many different parts of the globe, including the continent of Europe, Australia, New Zealand, Egypt and South America. It follows that he has acquired an unusually wide and varied knowledge of meters and meter practice the world over.



Mr. Stanley Lines

As president of the newly formed Chamberlain & Hookham Company he has now taken up his residence in the city of Toronto, with offices in the Kent Building. Already his good fellowship and cordial manners have made him many new friends, who with the old, wish him every success in his new field of labor.

Commission for Each Municipality

The Hon. Adam Beck has introduced a bill in which every municipality having a contract with the Hydro-electric Power Commission of Ontario must place the management of its electrical system in the charge of a commission. The bill provides for the election of commissioners on the same basis as light and water commissions are now elected. The bill is not intended to come into force immediately.

Two new wireless telegraph stations are to be established by the Dominion government at Alert Bay and Rivers Inlet, on the northern B. C. coast. Estimates are now being prepared. Any deficiency between the receipts from tolls and the cost of maintenance will be made good by the Associated Salmon Cannerys of British Columbia.

Industrial Progress and Trade Notes

Trade Publications

Standard Bushings,—Pamphlet issued by the Federal Sign System, of Chicago, descriptive of a number of types of bushing.

Asbestos,—Pamphlet issued by the H. W. Johns-Manville Co., descriptive of the J-M magnesia and electrical products.

Amsler Gas Producer,—Booklet, published by Walter Amsler, D.Sc., Pittsburg, descriptive of methods and costs of operation of producer gas engines.

Cooling Comfort,—Catalogue 108, issued by the Adams-Bagnall Electric Company, of Cleveland, Ohio, descriptive of the various types of Jandus electric fans.

Electric Light,—A little booklet issued by the Willard Storage Battery Co., Cleveland, describing their storage battery lighting equipments for automobiles.

Combination-Phones,—Booklet No. 239, issued by the Stromberg-Carlson Telephone Manufacturing Co., descriptive of their line of handy, convenient combination phones.

Electric Controllers,—1912 catalogue, issued by the Independent Electric Manufacturing Co., Milwaukee, describing their numerous electric controlling devices. The catalogue is splendidly illustrated and very complete.

Hans Renold's Driving Chains—A pamphlet giving concise information with illustrations of the different types of chain manufactured by Messrs. Hans Renold, Limited; also illustrations of various applications of the same.

Economy Equipment,—Catalogue No. 6 issued by the Economy Switchboard and Manufacturing Co., of Cleveland, descriptive of their line of switch boxes, outlet boxes, &c., push buttons, flexible conduit, pipe hangers, beam clamps, &c.

Mine Suspension,—Folder 4224, issued by the Westinghouse Electric & Manufacturing Co., describing and illustrating type B-3 mine suspension trolley wire clamp. Also folder 4202 describing the Westinghouse metallic flame arc lamp.

Cling-Surface Company, Buffalo, N.Y., have issued Bulletin No. 321, a neat folder showing eleven noteworthy installations in Pennsylvania where Cling-Surface is profitably used on belts. Each illustration is accompanied by data concerning the belts shown.

Portable Military Telephones,—Booklet No. 180, issued by the Sterling Telephone and Electric Co., of London, Eng., describing the features of a line of portable telephones, specially designed for military work; also publication No. 184, descriptive of Sterling electric blasting machines; Chapman & Walker, Toronto, Canadian agents.

The Appleton Electric Co. of Chicago are distributing their new 84 page catalogue. It is complete and covers in detail all the material manufactured by that company. They make a specialty of sherardizing their fittings, and have many new features in the line of Unilets which should be of interest to engineers and electrical contractors throughout the country.

Ornamental Street Lighting,—A booklet issued by the MacBeth-Evans Glass Co., Pittsburg, on the subject of Ornamental Street Lighting and Alba globes. The booklet is splendidly illustrated showing various handsome designs of ornamental lamp posts in various cities, including Dayton, Hamilton, Toronto, (several views) and Chicago. An interesting table gives the more important figures and speci-

fications of the ornamental street lighting system in operation in Dayton, Indianapolis, Toronto and Buffalo.

Fan Motors,—The Westinghouse Electric and Manufacturing Company has issued folders 4100 and 4101 covering their 1912 line of fan motors. One of these folders is devoted to alternating-current fans and the other to direct-current fans. Attractive art covers add greatly to their appearance. The new line of steel frame fans is well illustrated and described therein.

Electric Radiators,—Bulletin 19 issued by the engineering department of the National Electric Lamp Association, illustrating and describing the electric luminous radiator and calling attention to the many ways in which it may be made a convenience in the home. Comparisons are drawn between the non-luminous type of radiator and the luminous type; also bulletin 18 entitled Street Railway Lamps.

High Efficiency Transformers,—Catalogue issued by the Canadian Moloney Electric Co., Windsor, Ont., containing an illustrated description of the construction and operating features of their various types of transformer. A page is given over to the formulae for ascertaining the efficiencies of transformers at various loads and also all-day efficiency based on 19 hours no load and 5 hours full load. Another page gives a table of resistance, reactance, and impedance of circuits, for different sizes of wire.

Stuart, Drinkwater & Hingston, Limited

A new Montreal company to deal in general agency business has just been incorporated at Ottawa with a capital of fifty thousand dollars under the name of Stuart, Drinkwater and Hingston, Limited. This firm will represent, for Canada, the Brush Electrical Engineering Company, Limited, dealing in their complete line of electrical machinery, electric rolling stock, and electric supplies. In addition they will represent Messrs. A. W. Penrose & Company, of London, the well known manufacturers of the Penrose electric elevators. The new company will take over the Canada Ford Company, Limited, of which Mr. Stuart is President, Mr. Drinkwater, Vice-President, and Mr. Hingston, Secretary-Treasurer,—these three gentlemen constituting the sole shareholders of the companies.

Mr. Stuart, the president of the company, commenced his business career with the Bell Telephone Company of Canada, where he occupied the position of assistant purchasing agent until the Bell company disposed of their plant to the Manitoba Government, when Mr. Stuart went west to conclude the arrangements. Almost immediately after his return to the east the partnership was formed with Mr. Ford and Mr. Drinkwater under the name of the Canada Ford Company, Mr. Hingston later joining the firm. In September last Mr. Stuart, Mr. Drinkwater, and Mr. Hingston acquired the entire interests of Mr. Ford who retired from the business. The company has met with very considerable success in the last few months, and it is understood that the purpose of the new incorporation is really to grant the Canada Ford Company wider powers and identify the business more closely with the present active heads.

Mr. Drinkwater started his business life with Allis-Chalmers-Bullock Limited, leaving them to join the Canadian Fairbanks company, which company he left to enter the Canada Ford Company. Mr. Hingston's entire business career has been with the Canada Ford Company. He is a son of the late Hon. Sir William Hingston of Montreal.

Power Transmission by Silent Chain

In these days, when electricity is being generally adopted by manufacturers and power users of Canada, it is well to consider closely the question of transmission, as this very largely governs the difference between the cost per horse power as charged by the power company and the cost per useful or productive horse power at the machine. Hitherto the steam, gas or oil engine has provided a margin of power generally sufficient to cover losses in transmission without showing any increase in the power bill, but as power companies in general charge for the current taken by the motor and not the actual horse power which reaches the machine, unless the transmission is efficient and the frictional losses low hundreds of dollars may be paid each year for which there is no production.

There are many locations and conditions particularly suited for belts, ropes and gears and these systems will possibly never be discarded, but as the newer system of power transmission by chains is becoming more widely known, its advantages are being quickly appreciated and consequently many prominent Canadian firms are now installing chain drives. Chain driving also has its limitations, as for instance, where belts, rope or gear will satisfactorily transmit power at right angles. For such a plant chains cannot be utilized. On the other hand, where shafts are too far apart for a gear connection and too close for either belts or ropes, chains are frequently the only alternative. Further, chains are not affected by moisture, heat or oil, but belts or ropes slip under such conditions with resultant loss of power and destructive heat. Again, driving chains cannot be crossed, i.e., they are only suitable for transmitting power between shafts running in the same direction, and this in itself debars their use on fully half the machine tools where they would otherwise be applicable.

There are three principal types of chain for power transmission, viz.: Patent Silent Chain, for speeds up to 1,300 f.p.m., and, where special provision is made for lubricating, it may be run at still higher speeds; Bush Roller Chain, for speeds ranging from 400 to 900 ft. per minute; and, Solid Steel Block Chain, for speeds up to 400 f.p.m. In each type the links of the chain are blanked from steel strips of very high tensile strength and the bearing surfaces are of case hardened steel. Briefly the patent silent chain is suitable for practically all classes of high speed drives, the roller chain for heavy moderate speed drives and particularly for automobile transmission, and the steel block chain for the variety of purposes for which the malleable link chains have hitherto been used.

In the present article we wish to draw particular attention to the patent silent chain as it is specially suitable for use in conjunction with electric motors. The advantages of this chain are briefly as follows:—

Efficiency—The efficiency is very high and constant as the principle of the chain is that of tooth gearing, and all possibility of slip is eliminated. Journal friction is at a minimum as the chain can be run practically slack on the wheels. With belts this is not the case, considerable tension frequently being necessary and particularly is this the case with small pulleys of high speed electric motors. Although these chains wear with continuous service, the efficiency is constant for the reason that the chain automatically rises on the wheel teeth as the pitch increases.

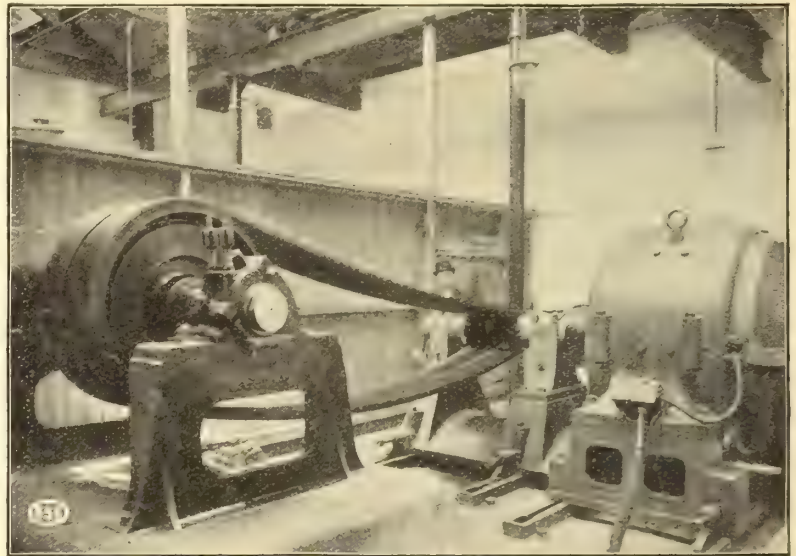
Durability—This point is largely governed by the conditions of each particular drive. There are chain drives running in Canada installed five years ago replacing other forms of transmission which could not stand the severity

of the load and continuous service and which have been running regularly day and night since they were installed and have not given any trouble whatever. Other drives have been in regular service upwards of seven years and the makers usually advise that the patent silent chain will run up to ten years without giving any trouble.

Quiet Running—As the name implies the chain is "silent," in many instances the gear making no greater sound than a medium sized belt.

Compactness—This is one of the most important advantages chain transmission offers over belts and it gains admission for the system into an unlimited field of applications. The chain sprockets are approximately 50 per cent. of the size of belt pulleys of the same capacity and they may be placed quite close together thus economizing arrangement of machines.

Design—The success of a chain drive is of course essentially a function of the design and material of construction. In a well designed gear, the action of the chain entering the wheel is purely a rolling one, and except on wheels with exceptionally few teeth, sliding and hammering may be practically eliminated. The strength of a



Silent Chain Transmitting Power From Motor to Line Shaft in Calico Printers' Association

chain depends more upon the bearing area of the studs connecting the links than any other feature and this should be ample with the load distributed. The material of the wheels should be influenced by the ratio of the speeds between the driving, and driven, shafts and should be such that the wear on each wheel is the same. The life is considerably shortened if the wear on the wheels is not proportional.

To many the first cost of a chain drive is an obstruction, this being about 50 per cent. higher than a belt drive of equal capacity, but it should be borne in mind that the higher efficiency, saving in power and increased production not only means a more satisfactory transmission but also a less costly one in the long run. There are many hundreds of them in use in Canada, a very large majority of which are transmitting upwards of 75 h.p. with centers as short as 4 feet. No doubt as the Renold chains become more widely known and their advantages are fully appreciated their use will become still more general.

The cut shown herewith illustrates an installation of Renold silent chain drive transmitting power from an electric motor to a line shaft in the works of the Calico Printers' Association, Ltd. These chains are supplied by Messrs. Jones & Glassco, Montreal, Canadian agents for Hans Renold, Limited.

Canadian Tungsten Personals

Mr. F. Goodwyn, sales manager of the company, spent a few days in Montreal recently and states that he is well pleased with the prospects in that city.

Mr. J. W. Moncur, Montreal Manager of the company, was recently married to Miss Burrows. We understand that another branch manager of the Tungsten Co. is also on the verge of matrimony.

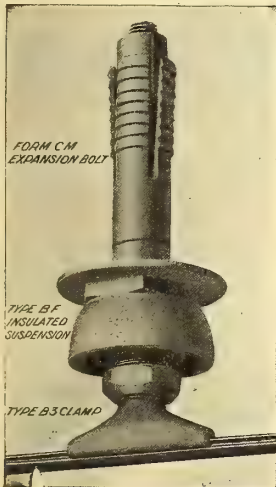
Mr. W. T. Grose, of Montreal, was in Hamilton recently attending a board meeting of the Canadian Tungsten Lamp Co. His many friends will be glad to hear that he has entirely recovered from his lengthened illness.

Mr. W. H. Ginder, president of the Canadian Tungsten Lamp Co., attended the Jovian Convention in Buffalo last week and expressed himself delighted with the hospitable manner in which the Canadian representatives were entertained by their U. S. cousins.

Mr. Mainor of the Jas. Stuart Electric Co., Winnipeg, and Mrs. Mainor spent some days in Hamilton recently and took the opportunity of visiting the Canadian Tungsten Lamp Company's works on Canon street. Mr. Mainor stated that he was amazed at the size of the plant and took particular interest in the department for manufacturing the drawn wire filaments. It is not often the Canadian Tungsten Lamp Co. have the pleasure of meeting their friends in this way, and they are at any time only too pleased to show them through their entire works. Their laboratory and department for making drawn wire filaments are, we understand, the only ones at present in Canada and are always a source of the greatest interest to anybody connected with the electrical trade.

A New Mine Suspension

The Westinghouse type B-3 mine suspension is illustrated herewith. This clamp has only three parts which cannot be taken apart. Because of its simplicity it can be installed quickly and cheaply.



The clamp complete, with nut loosened, is screwed on the insulator stud, the wire is inserted in the lips of the clamp and slips freely into place without the least forcing; then the nut is tightened. Screwing down the nut clamps the wire firmly and also clamps the stud, so that the ear can be placed in any direction and yet be tight on the stud. This makes it unnecessary to twist the insulator after screwing the ear up tight. The wire can be drawn through for taking up slack by simply loosening the nut. This does not permit the

wire to drop out. All parts of the clamp are sherardized, and perfect clearance for the trolley wire is provided. A wrench is the only tool required.

A manufacturer of lifting magnets in the United States is reported to be making experiments on the construction of their coils using aluminum instead of copper windings. This type of winding has been used to some extent in the manufacture of motors especially for electric railway use. Equipment of this type has been in use on the European continent and is reported to give very satisfactory service. The wires are rectangular in cross section and consecutive coils are wound without any intervening insulation other than the oxide which forms on the aluminum.

Will Represent Thomas & Smith**Mr. J. J. Martindale**

Thomas & Smith, Inc., Chicago and New York, manufacturers of the well-known economy pumps, announce that their products in Ontario and Quebec will in future be handled by Mr. J. J. Martindale, 112 Mail and Empire Building, Toronto. Mr. Martindale is a 1901 graduate of the University of Pennsylvania in the electrical engineering course. Since his graduation he has had three years telephone, power station and machine shop experience in various sections of the United

States, followed by seven years in electric railway work, comprising construction, operation, maintenance and engineering with the Michigan United Railways Company. Mr. Martindale also represents the Canadian Westinghouse Company for overhead electric railway material, the Electric Railway Improvement Company, of Cleveland, the United Electric Company, the Tuec stationary vacuum cleaner and a number of other electric lines.

Special Announcement of Ohio Brass Co.

"We regret to announce that Mr. P. A. Hinds, who travels Canada, was run down by an automobile recently and will be confined to the Toronto General Hospital for several weeks. Until he is able to travel again, you will greatly oblige us by sending orders and inquiries direct to us at Mansfield where they will have prompt and careful attention. We will arrange to send a salesman from here or from one of the branch offices to care for special inquiries."

Supply Department Gets New Head

Mr. F. A. Pample, formerly of the Northern Electric & Manufacturing Company, of Montreal, has moved to St. John, having accepted a position with the St. John Street Railway Company as head of the Supply Department. The St. John Railway Company carries in stock and distributes throughout the Maritime Provinces practically every line of electrical supplies. We understand that under the efficient management of Mr. H. M. Hopper all the company's operations during the past year showed marked progress. In the electrical supply department this was especially so.

The Pacific Heating Company has been incorporated with a capital of \$100,000 to manufacture and deal in all kinds of electrical devices and appliances, etc. The head office is at Davis Chambers, 615 Hastings street west, Vancouver, and R. R. McCrea is the company's attorney.

The Locke Insulator Manufacturing Co. have recently closed contracts for a number of suspension type, high voltage, transmission insulators. These include orders from The Mexican Northern Power Co., 110,000 volts, and from The Puebla Tramway, Light and Power Co., 110,000 volts.

The city's attempt to insert a provision in the Toronto Suburban Railway Bill for entrance to the city of Toronto, to the effect that the council should have power to take over this part of the suburban line when the franchise of the Toronto Railway Company expires in 1921, was defeated in committee.

Current News and Notes

Acton, Ont.

The by-law to expend \$8,500 on electric buildings and equipment carried.

Barkerville, B.C.

The Antler Goldfields & Development Co., Ltd., are reported to be considering the installation of a large hydraulic plant at the junction of Antler and Russian Creeks.

Berlin, Ont.

Sir Wm. Mackenzie is reported to have promised that if the town of Berlin will secure for his company a right-of-way into the factory district, the road which it is proposed to build this summer from Toronto to Guelph will be extended to Berlin.

The village of Bridgeport has made application to the Berlin Light Commission for a supply of power from the sub-station here. The Light Commission has asked permission from the Hydro-electric power commission and it is likely the pole line will be constructed to this village.

Brantford, Ont.

The estimates submitted by the Hydro-electric Power Commission for the cost of installing apparatus capable of distributing 1,000 h.p. in this vicinity amount to not less than \$98,849 and not more than \$178,602, depending on the system installed. The least expensive is an overhead system using wooden poles; the most expensive, an underground distribution with installation of 5-light ornamental standards.

Calgary, Alta.

The city of Calgary recently awarded contracts to Lindsley Bros. and Western Supply Co., both of Calgary, for a supply of poles.

The city of Calgary, City Engineer, J. T. Child, will purchase 140 magnetite arc lamps 2000 c.p. and 464 ornamental standards 400 c.p.

Commissioner Graves is of the opinion that the electric department has no right to pay taxes owing to the fact that power and light are being supplied practically at cost. As a result the different public utilities of Calgary will be exempt from taxation this year and it is likely the arrangement will continue indefinitely.

Dundas, Ont.

It is reported the Dominion Power & Transmission Co., Hamilton, General Manager, W. C. Hawkins, Terminal Station Bldg., will erect a new substation and remodel the lighting plant here.

Edmonds, B.C.

The Police Commissioners have decided to call for tenders on installing police telephone system, necessitating installation of 15 stations on B.C.E.R. poles.

Edmonton, Alta.

The operations of the electric railway for the month of January show a deficit of \$5,803. The other municipal systems including the telephone and the electric light plants show a good profit.

Edmonton, Alta.

Superintendent Huffman's report for January shows that the cost of operation on the power plant was reduced by 17 per cent., this in the face of an increase in the cost of coal to \$3.25 per ton, as against \$2.60 a year ago. This means a total saving of approximately \$5,000.

Fort Erie, Ont.

It is reported the village of Fort Erie will install an electric fire alarm system, 8 call boxes, 20 house gongs, large central gong and central for call boxes.

Fredericton, N.B.

A project is on foot to connect Fredericton with Springhill some 5 miles distant with an electric line. It is proposed to use a storage battery driven car.

Application has been made for the incorporation of the Gloucester Light and Power Co. The object of the company is to furnish electric light and power in Bathurst and other points in Gloucester county.

Halifax, N.S.

The Public Utilities Act of Nova Scotia is being amended to give the Commission jurisdiction over the electric tramways of the province.

Hamilton, Ont.

The Board of Control Chairman, Mayor Geo. H. Lees, will shortly call for tenders for wiring all fire stations and other municipal buildings.

W. A. Wood, of Brantford, representing an automatic telephone company, is trying to interest the Hamilton council. The Bell Telephone Company's franchise expires this year.

Innisfail, Alta.

Electric light tenders for the new plant have been accepted as follows: Engines and boilers, Robb Engineering Co. generating equipment, Canadian Westinghouse Co.; line supplies, Canadian General Electric Co. The \$15,000 debentures issued for the above purposes have been purchased by Amelius Jarvis & Co., Toronto, at 96.11 and accrued interest.

Kenora, Ont.

This town is asking the government for permission to amend the act of incorporation of the Keewatin Power Co. Some years ago when this company was formed it appears to have been the understanding that a dam would be built and a hydro-electric plant installed to be used in the industrial development of this system. The dam has been built known as the Norman dam at a considerable cost but no attempt has been made to develop power. All this time the Keewatin Power Co. is holding a property which is rapidly increasing in value but by their franchise have no taxes to pay. The town of Kenora by this move expects to be able to force the company to pay a reasonable tax which they hope will result in inducing the company to proceed with the installation of its electric plant.

Kincardine, Ont.

A committee was recently appointed to interview the different manufacturers and power users in this town regarding the amount of power that could be used providing the Hydro-electric Commission could quote a satisfactory rate. The committee has since reported that they have applications for 420 h.p. which are dependent however, on the rate that may be obtained.

London, Ont.

The ornamental street lighting system will probably be extended on Richmond street north from Oxford to Grosvenor street.

The London Electric Light Co. has put in a bid to supply the current for the street lighting system of London, for \$22,000, as against \$25,000 to be charged by the Water Commissioners. Later reports state that the offer was not accepted.

Medicine Hat, Alta.

The ratepayers will vote on several industrial by-laws and the electric railway by-law in the near future.

Melfort, Sask.

The ratepayers will vote on a by-law to provide \$2,500 for telephone purposes.

Merritt, B.C.

An offer has been received from the Merritt Power and Light Co. to sell out their plant to the town.

Mimico, Ont.

The location of the transformer station for Mimico and North Toronto will be on 6th street near New Toronto street. It is expected that this station will be commenced in the near future.

Moose Jaw, Sask.

The by-law asking \$225,000 for electric light extensions was voted on Mar. 21st.

The city of Moose Jaw will receive tenders until March 30th for one 1500 kw.a.c. steam turbo generator and one 500 kw.a.c. generator direct connected to Diesel oil engine.

Tenders will be received by Commissioners until March 26th for supply of copper and iron wire, cedar poles, cross arms, pole line hardware, miscellaneous line supplies. J. D. Peters, City Electrician.

New Hamburg, Ont.

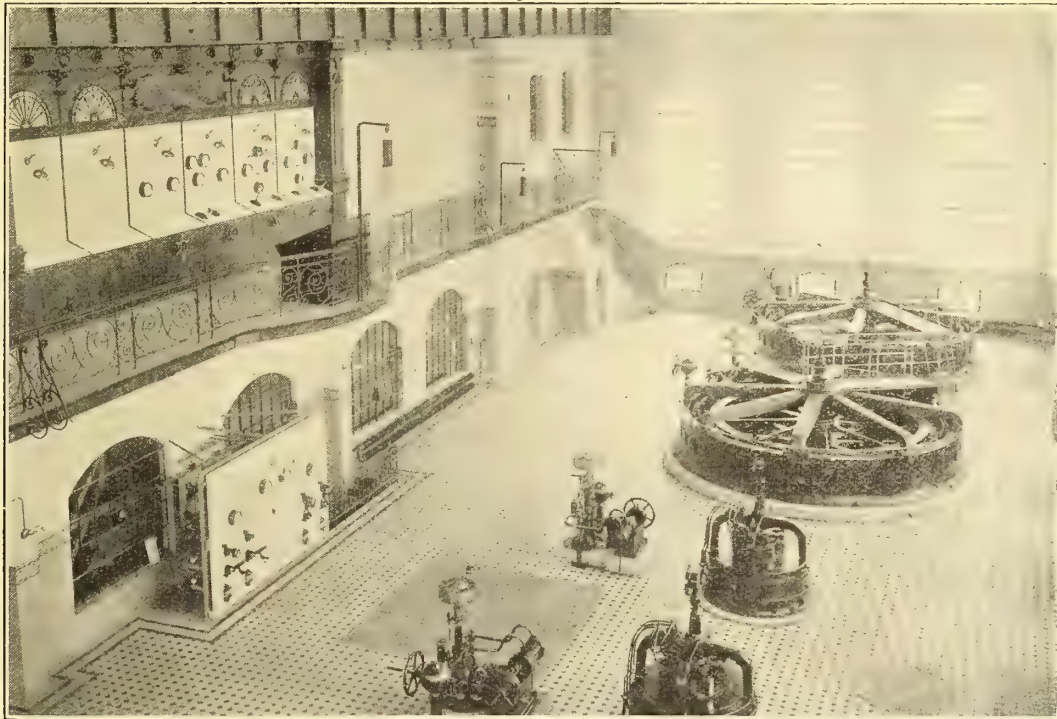
The Board of Trade committee has just completed an agreement with certain United States capitalists who will erect a \$40,000 plant within the limits of the corporation for the manufacture of electrical appliances. A by-law will be submitted giving power to close this contract.

Niagara Falls, Ont.

The Canadian Niagara Power Co. is reported to contemplate the immediate extension of their power house.

A plan is under discussion by which the State of New York and the province

SIEMENS



View showing two Siemens 2500 K.V.A. 150 r.p.m. Vertical Water-wheel Generators, a further two 2500 K.V.A. 150 r.p.m. and one 5500 K.V.A. 150 r.p.m. Generators have since been added

The Siemens Companies manufacture horizontal and vertical water wheel-generators and have a great number of both types in successful operation in all parts of the world with outputs up to 16,000 h.p. and pressures up to 20,000 Volts. More than 50 machines with terminal pressure of 10,000 Volts and over have been constructed.

Siemens Brothers Dynamo Works Limited

London, England

Paris

Berlin

St. Petersburg

Vienna

New York

Head Office for Canada

Canadian Birkbeck Building, TORONTO

Branch Office: 707 McArthur Building, WINNIPEG

of Ontario would co-operate in illuminating the falls at night.

The contract for the completion of the power house building of the Toronto Power Co. has been awarded to Page & Co., Toronto, and work will begin almost immediately.

It is reported that Edson Pollard representing a United States syndicate, has submitted an offer to purchase the electric light plant and that a by-law covering this matter will be submitted in the near future.

Nutana, Sask.

The Iloeschen Wentzleu Company are reported to be considering the installation of a private power plant for brewery work.

Orillia, Ont.

The lighting rates will probably be raised here. The flat rate system is in operation, the rate being 25c. per month for 16 c.p. lamp for residence and 30c. for stores, hotels and offices on the supposition that these latter use their lamps for a greater number of hours. A 20 per cent. discount will be given off these figures making the net rate 20c. and 24c. The present rate is 18c. and 22c.

Ottawa, Ont.

Plans have been prepared for electrical conduit work; construction will probably start in spring. City Engineer, N. J. Ker.

The Ottawa city lighting department contemplates 4000 lin. ft. of lighting system ("Great White Way") on Rideau street. J. E. Brown, Elec. Supt.

The Ottawa Street Railway Co. will make the following extensions: Ottawa South loop, estimated cost \$26,000; Preston street loop, estimated cost \$37,000. If Government consent is obtained, company will also run line on Wellington street, cost \$32,000.

Port Arthur, Ont.

The Joint Board of Commissioners composed of members from both Port Arthur and Fort William, are asking the city council of each city to purchase two more street cars in anticipation of increased summer traffic.

A new lighting schedule has been adopted by this city as follows: residence, fixed charge of 4c. per 100 sq. ft. plus $3\frac{1}{2}$ c. per kw.h. Commercial lighting, 8c. per kw.h. for the first hours use of installed capacity for 26 days a month and $3\frac{1}{2}$ c. per kw.h. for the balance. The rate for sign, window and display lighting is to be \$5 per month per kw. connected. All rates are subject to 10 per cent. discount.

Port Credit, Ont.

The rates for residence lighting have been fixed at 4c. per month per 100 sq. ft. of area lighted, plus $4\frac{1}{2}$ c. per kw.h. on the total consumption, as shown by meter. Commercial rates have been placed at 12c. per kw.h., for the first 30 hours use of the installed capacity each month, plus $4\frac{1}{2}$ c. per kw.h., for the remainder.

Port Dalhousie, Ont.

The Maple Leaf Rubber Co., which supplies light to this village has refused the council's offer of \$5,500 for their plant. It was the intention, if this price had been accepted, to take the electric

plant over and operate it as a municipal enterprise. It is said that the council is now applying to the Hydro-electric Power Commission for a supply of light and power.

Portage La Prairie, Man.

The report of the municipal electric light plant for the first 3 months of its operation by the city shows a profit of \$2,800.

Port Stanley, Ont.

Niagara power was turned on in this village for the first time on March 10th. Port Stanley is fed from the sub-station at St. Thomas by a 13,200 volt line.

Princeton, B.C.

The Princeton Coal & Land Co. have secured water rights on the Similkameen river. Their present plant which supplies light to their employees will have to be enlarged to supply the town.

Prince Albert, Sask.

Engineer C. H. Mitchell is reported to have located a satisfactory site for the dam to be built in connection with the power development scheme. The original trouble was that a satisfactory foundation could not be located for the concrete structure.

Regina, Sask.

Appropriation of \$200,000 has been made for extension of street railway system. H. Doughty is Electrical Superintendent.

St. John, N.B.

The St. John River Hydro-electric Co. Act of Incorporation came up before the New Brunswick Government during the month of March. If the bill passes it is expected that development work will be proceeded with this summer.

It is reported that the New Brunswick Hydro-electric Power Co., St. John who have secured water rights on Lepreaux and Magaguadavic Rivers (13,000 acres), will start development work in May. 10,000 horse power to be developed.

St. Marys, Ont.

Lighting rates in St. Marys have been fixed as follows: for private residences, 4c. per 100 square feet plus meter rate of 6c. per kw.h.; or a straight meter rate of 10c. per kw.h., with a minimum of 50c. per month. Commercial lighting, 12c. per kw.h., on the actual capacity installed for the first hours use per day, for 26 days a month, the balance at the rate of 7c. per kw.h.

St. Thomas, Ont.

The city of St. Thomas, City Engineer, M. H. Baker, will submit a by-law asking power to expend \$30,000 as follows: Three new street cars; repairs to old cars; repairs to overhead work; 60 lb. steel rail on lines to be extended.

Stratford, Ont.

The annual report of the Stratford Light and Heat Commission, showing the year's operations since the installation of Niagara power indicates a deficit of \$400 on the year's operations. The total income was \$9,311 and the total expense \$9,720. It is noticeable also that no allowance is made for depreciation.

Sydney, C.B.

The Cape Breton Electric Co. through their manager, Mr. H. C. Foss, has submitted a detailed offer for lighting the city streets as follows: Arc lamps consuming approximately 450 watts, \$86.07 a year; 200 c.p. incandescent lights, \$62.62 a year; 5-light clusters containing five 40 c.p. incandescents, \$62.88 a year; 40 c.p. incandescent lamps, \$19.09 a year; 60 c.p. incandescents \$22.54 a year. The offer suggests a 5-year contract with a 5 per cent. reduction on the above rates if a 10-year contract is given.

Thorndale, Ont.

The village of Thorndale will shortly vote on a by-law to make a contract with the Ontario Hydro-electric Commission.

Thorold, Ont.

The town of Thorold will install an ornamental standard street lighting system. 30 cluster electric standards to be purchased.

Toronto, Ont.

The estimate for the street lighting, for the year 1912, is \$234,000. This is for 26,000 tungsten lamps at \$9 per year each.

Controller Church proposed to enlarge the scope of the Toronto Hydro-electric Commission so as to make it a Public Utilities Commission.

The report that the Toronto Hydro-electric department would sell fixtures and general electric supplies at their new store on Yonge street has been denied.

Estimates recently brought down by Prime Minister Whitney, of the Ontario Legislature, contained the sum of \$2,000,000 for hydro-electric extensions in Western Ontario.

The Toronto Railway Co. will, at the order of the Ontario Railway & Municipal Board, install a number of safety switches at points and of a type to be determined by the Commission's engineer.

Tenders will be received by the city of Toronto until March 26th, for one 200 h.p. vertical motor, two 75 h.p. vertical motors, and one 9 panel switchboard. Plans and specifications at engineer C. H. Rust's office.

The Toronto Hydro-electric Commission has been granted permission to carry its transmission line across the eastern channel. Two large steel towers will be used, one on either side of the channel but the rest of the line will be carried on wooden poles. Transmission is at 13,200 volts.

Steps are being taken by the Hydro-electric Commission of Ontario to appropriate the Chats Falls which at present are owned by the Hon. Wm. Harty of Kingston. It is understood that the intention is to supply power to those sections of eastern Ontario district not at present supplied by the Hydro-electric system or by the Electric Power Co.

Tuque, Que.

This town contemplates issuing of debentures for \$100,000 to be spent on waterworks and lighting system.

Vancouver, B.C.

The B.C.E.R. Co. will erect a sub-station at the junction of Earle road

New WESTON INSTRUMENTS

A Full Line of Alternating Current Switchboard Indicating Instruments

is offered by this Company, comprising:

WATTMETERS, Single and Polyphase.

POWER FACTOR METERS.

SYNCHROSCOPES.

FREQUENCY METERS.

VOLTMETERS.

AMMETERS.

and New Models of Weston D.C. Instruments to match

This whole group of instruments embodies the results of several years exhaustive study and scientific investigation of all the complex electrical and mechanical problems involved in the development of durable, reliable, sensitive and accurate instruments for use on alternating current circuits.

Every detail of each of these instruments has been most carefully studied and worked out so as to be sure that each shall fully meet the most exacting requirements of the service for which it is intended. Neither pains nor expense has been spared in the effort to produce instruments having the longest possible life, the best possible scale characteristics, combined with great accuracy under the most violent load fluctuations and also under the many other trying conditions met with in practical work. Every part of each instrument is made strictly to gauge and the design and workmanship and finish is of the highest order of excellence.

We invite the most critical examination of every detail of each member of the group. We also solicit the fullest investigation of the many other novel features and very valuable operative characteristics of these new instruments and request a careful comparison in all these respects with any other make of instrument intended for like service. We offer them as a valuable and permanent contribution to the art of electrical measurement. Their performance in service, will be found to justify the claim that no other makes of instruments approach them in fitness for the service required from A.C. Switchboard indicating instruments.

Full particulars of design, construction, prices etc., are given in Catalogue E. N. 16. Write for it.

WESTON ELECTRICAL INSTRUMENT CO.

Main Office and Works, Newark, N. J.

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San Francisco, 682 Mission St.
New Haven, 29 College St.
Cleveland, 1522 Prospect Ave.

Paris, 12 Rue St. Georges.
Berlin, Genest St. 5 Schoenberg.
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Winnipeg } Electric &
Vancouver } Manufacturing
Calgary } Company

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British Insulated and Helsby Cables Limited

POWER CABLES

For Working Pressures up to

30,000 Volts

Sole Canadian Representatives:

Canadian British Insulated Company, Limited

Cablegrams "Insulator" Montreal
Telephone Main 1521, Montreal

Power Building, Montreal

and the company's Westminster inter-urban right-of-way. The cost is estimated at \$100,000. The building will be of concrete.

Walkerville, Ont.

By-laws are being submitted by which the Walkerville Light & Power Co., Ltd., shall have power to extend their operations into the township of Sandwich East and by which a 20-year franchise is granted to the company. The rates which the company may charge in this municipality shall not exceed 15c. per kw.h. for lighting or 5c. for power. A second by-law authorizes a contract between the company and the township, by which the former supplies the township with electric current for street lighting.

Welland, Ont.

The Niagara Falls, Welland & Dunnville Electric Railway Co. are increasing their capital to \$500,000, their bonding power to \$30,000 a mile and are asking power to generate and distribute electricity for light, heat and power purposes.

Weyburn, Sask.

The Prospect Rural Telephone Co. will receive tenders for new telephone lines until March 25th.

Winnipeg, Man.

The city of Winnipeg power department will call for tenders for two or three electric trucks. J. G. Glasco, power engineer.

The city of Winnipeg has awarded a contract to the Imperial Wire & Cable Co., Montreal, for 25,000 lbs. No. 8 weather-proof wire to cost \$4,137.50.

Moonlight Schedule for April 1912

Courtesy of the National Carbon Company, Cleveland, Ohio.)

Date.	Light.	Date.	Extinguish.	No. of Hours
Apr. 1	No Light	Apr. 1	No Light	
2	6 50	2	9 00	2 10
3	6 50	3	10 10	3 20
4	6 50	4	11 20	4 30
5	7 00	5	0 30	5 30
6	7 00	6	1 30	6 30
7	7 00	7	2 30	7 30
8	7 00	8	3 10	8 10
9	7 00	9	4 00	9 00
10	7 00	10	4 30	9 30
11	7 00	11	4 50	9 50
12	7 00	12	1 40	9 40
13	7 00	13	4 40	9 40
14	7 00	14	4 40	9 40
15	7 10	15	4 40	9 30
16	7 10	16	4 40	9 30
17	7 10	17	4 40	9 30
18	7 10	18	4 30	9 20
19	7 10	19	4 30	9 20
20	7 10	20	4 30	9 20
21	10 30	21	4 30	6 00
22	11 30	22	4 30	5 00
23	0 20	23	4 30	4 10
24	0 50	24	4 30	3 40
25	1 20	25	4 30	3 10
26	1 50	26	4 20	2 30
27	2 10	27	4 20	2 10
28	No Light	28	No Light	
29	No Light	29	No Light	
30	No Light	30	No Light	
Total.....178 10				

Condensed Department

RATE

Positions Wanted } 2 cents a word per insertion.
Positions Vacant }
Miscellaneous. }

Tender advertisements, equipment for sale, etc., 15 cents per agate line (14 agate lines make one inch) per insertion.

Advertisers who wish to conceal their identity may do so by using an Electrical News box number without extra charge.

Forms close on the 18th of each month.

Situations Wanted

Electrical Engineer, 10 years experience, desires position as Superintendent of Hydro-Electric Power House, or take charge of lighting and power of small town, East or West. Apply Box 420, Electrical News, Toronto, Ont. 4

Mechanical Electrical Engineer, fifteen years experience, all systems, all voltages; best of recommendations; desires a change. Address Box No. 444, Electrical News, Toronto, Ont. F

Works Electrician desires change, present position eight years in charge of large industrial plant, accustomed to both A.C. and D.C. apparatus. Testing, Repairs, Installation, Maintenance. Good supervisor, can instruct or do work myself. Box 443, Electrical News, Toronto, Ont. F

Municipal Electrical Superintendent with 12 years' American and Canadian technical and practical experience in up-to-date methods of plant maintenance and operation, transmission, line construction, high or low tension, distribution of services, installation of meters, motors, and other modern power appliances, arc or incandescent street lighting systems, desires change to a growing town or small city; can produce results; married, age 36 years, Graduate S. C. S. West preferred. A1 references. Box 392, Electrical News, Toronto, Ont. F

Am I the Engineer you are looking for? Age 36, Canadian; good technical education, A.I. Draftsman, specializing on detail and design of overhead construction equipment.

Fifteen years Canadian and American experience in practical and commercial end of Telephone, Light and Power business.

Past two years on engineering work for large Hydro-Electric Power and Light concern. Possess executive ability and know my business. Am desirous of change. What am I worth to you?

Apply Box 467, Electrical News, Toronto, Ont. 4

Situations Vacant

WANTED—Experienced operator for Hydro-Electric Plant. \$75.00 per month with good chances of advancement. Apply Sherbrooke Railway & Power Company, Sherbrooke, Que. 4

SALES ENGINEER

Sales Engineer:—Large Electrical Manufacturing Company wishes to employ two young men in the Machinery Sales Department; college training and shop experience required; selling experience not necessary, but such experience will be given extra consideration.

Apply Box 440, Electrical News, Toronto, Ont. 3 4

Miscellaneous

Contract To Let

Parties having about 60 or 70 miles of heavy ballasting and trainfilling to do, are willing to sub-let the work to substantial people provided same will rent rolling stock, Lidgerwood and cars now on hand. Apply Box 402, Electrical News, Toronto, Ont.

For Sale

Ayr electric light plant in first class condition, steam power, good service and contracts. Exclusive franchise in town of 1,200. A splendid chance for a practical man. Being sold because of owner's death. Apply D. M. Clark, 15 Mc Kenzie Crescent, Toronto, Ont. 2 TF

Plant For Sale

Electric light plant and water power in Western Ontario, at present rented and in good running order. Also farm, on which plant is situated, suitable for grazing or cultivation. For further particulars apply to R. C. Pearce, Paisley, Ont., or D. McIntyre, 1943 Smith Street, Regina, Sask., proprietor. 3-6

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KENT BROTHERS
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Gen. Man. Western Canada, Toronto



BRUSH

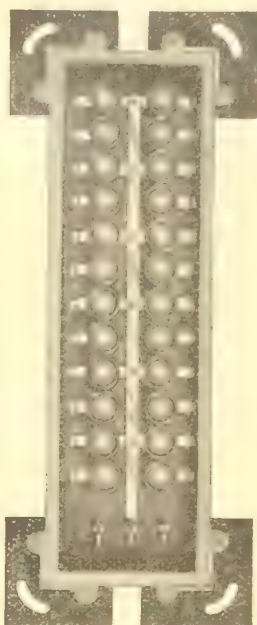
P R O D U C T S

We have made arrangements whereby we are now prepared to supply from stock the Brush Carbon Lamp whose efficiency we are prepared to guarantee. This Lamp is without question the best carbon lamp imported into this country to-day. We will carry a large stock at all times in Montreal for your requirements, and we know no other imported carbon lamp which is made in accord with the Standard American Specifications at these prices.

Canada Ford Company Limited, Montreal

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The "Superior" Way



Better than any other way

MANUFACTURERS OF

Narrow Type Panel Boards
Switch Boards
Electrical Distributing Apparatus
Steel Cabinets

Write for our NEW 1912 CATALOG, ready April 1st.

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This New Iron Will Stimulate Large Sales

Your sales of

Economic Heating Appliances

will receive an added impetus if you offer **this New Iron**. It is certainly the most perfect model that has ever been produced. All the old drawbacks of earlier models have been overcome. It consumes 20% less energy at a given heat than any other Iron on the market. It will **never** burn out. Rated voltage 110 v. tested for 20 minutes at 220 v. The most serviceable and economical electrical appliance ever made.

The new electric 3 heat disc stove is most carefully constructed to give the greatest heat at the smallest working cost. It is strongly made and beautifully finished, it will never break or burn out.

Royce Electrical Economic Heating Appliances are luxuries within the reach of **all** the busy hostess, college girl, maid or bachelor. The time, money and trouble they save, the dirt and danger they do away with will make them the most popular Heating Appliances for your season's trade.

Royce & Co., Manufacturers, West Toronto, Ont.

Write to-day for illustrated catalog and Agency terms.

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ARE MADE BY LAMP MAKERS

We don't make anything else

**It's good to know one line of
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**The lamp that is built up to a
standard, not down to a price**

Manufactured by

**The Canadian Sunbeam Lamp Co.
Limited**

**Main Office and Factory:
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C. G. E. Wood Strains

The Strongest Wood Strain Insulator Ever Made

1 3/4" diameter, 5" or 12" between cap, takes test load of 10,000 pounds and a breaking load of between 15,000 and 18,000 pounds.



All
C.G.E.
1" and 1 1/4"

Wood Strains

are built on the same lines and are proportionately of the same enormous strength.

End castings are *sherardized* by the special C. G. E. process.

Only *perfect* sticks are selected from properly seasoned lumber. These sticks receive special oil treatment which thoroughly oxidizes.

The transparent finish, rendering imperfections discernible, invites *your* personal examination.

Every insulator is rigorously tested and repeatedly inspected during process of manufacture. A final, thorough inspection is given every wood strain before shipping.

Local warehouses have large stocks on hand, insuring immediate shipment.

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Canadian General Electric Co. Limited

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Montreal
Calgary

Halifax
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Ottawa
Nelson

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Prince Rupert

Stuart Howland Co.

BOSTON

Exclusive Selling Agents for many Manufacturers. Jobbers of

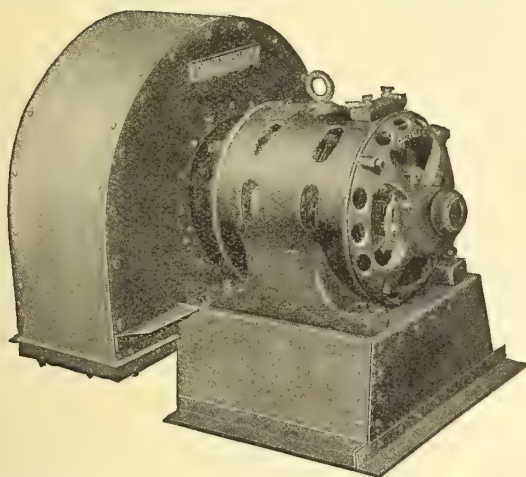
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Largest and most complete stock of Pole Line Construction, Lighting, Street Railway and Telephone Material. If you want goods now call on us—we have them. Our facilities are unequalled; our location a distinct advantage for Canadian buyers over other large distributors in the U. S. TRY US.

For the operation of Heating and Ventilating Fans, Organ Blowers, etc., where quiet operation is necessary,

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SINGLE PHASE MOTORS



will be found superior. Manufacturers of such apparatus have pronounced them the most quiet of any on the market. They are particularly suited to remote and automatic control.

Century Electric Co. 19th & Olive Sts.
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STEEL — (Not Cast Iron)

Are the most Modern Fittings for Exposed Conduit Work

ONCE TRIED - ALWAYS USED

Because they are much lighter and stronger and at the same time giving more room in the box to do the work than is found in cast iron boxes. They are also very neat in appearance and are now used by the most exacting contractors throughout the land because they make the job.

Made in all types and sizes from 1/2" to 1 1/2"



No. 0



No. 6



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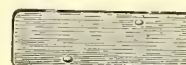
No. 2



No. 5L



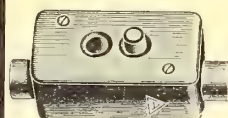
Metal Nipple Cover



Blank Metal Cover



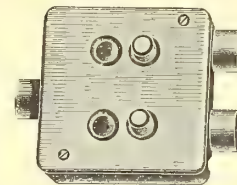
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Send at once for
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Specify 'Appleton'
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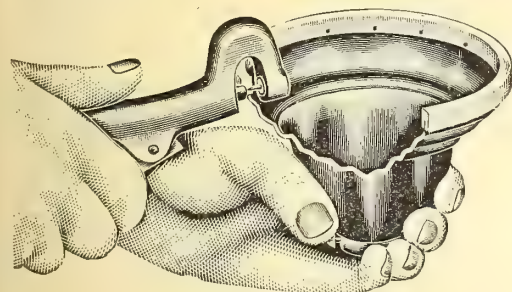


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E.E.B.
TRADE MARK



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PATENTED APRIL 15th, 1911

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No. 2. Shows Strip Insulator fastened. Included in the list of approved Electrical Fittings issued by the Underwriters National Electric Association.

4" and 10" curles contain from 64" to 66". One 4" curle contains sufficient insulation for four 5", three 6" or two 10" shells.

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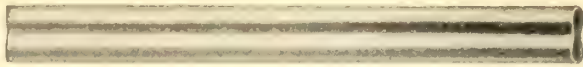
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Sizes 14 to 0000 B & S



A Perfect Joint With $3\frac{1}{2}$ Turns

THE HOLTZER-CABOT TUBULAR WIRE CONNECTOR

A Seamless Drawn Connector which makes a perfect self welding joint exceeding the wire in tensile strength.

No Plugged Sleeves as in the brazed type. Thickness uniform throughout the length. No chance for moisture to enter.



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Before
and
After
Twisting



A trial will demonstrate their superiority.

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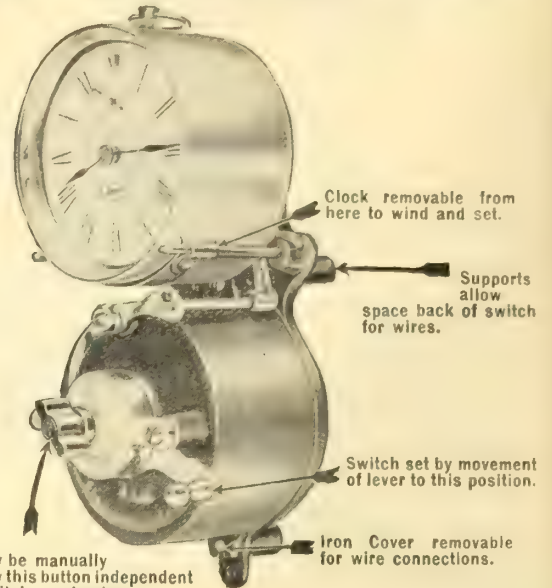


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**Transformers
Time Switches
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ONE-DAY TIME SWITCH

TYPE "A"

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The successful Business is the one that takes into consideration the requirements of its customers; in other words, gives them efficient service.

You can assure your customer this service when you carry

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Designs are always original, rich appearing, and pleasing with the most durable finish that can be had.



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Protected by U. S. Patents



Made from hard white porcelain and very carefully manufactured.

No burrs or rough edges to cut insulation.

Write for prices and sample.

The success of this insulator is due to the fact that the cap needs no centering and firmly grips the wire when screwed into place.

Trial orders packed 500 in a box.

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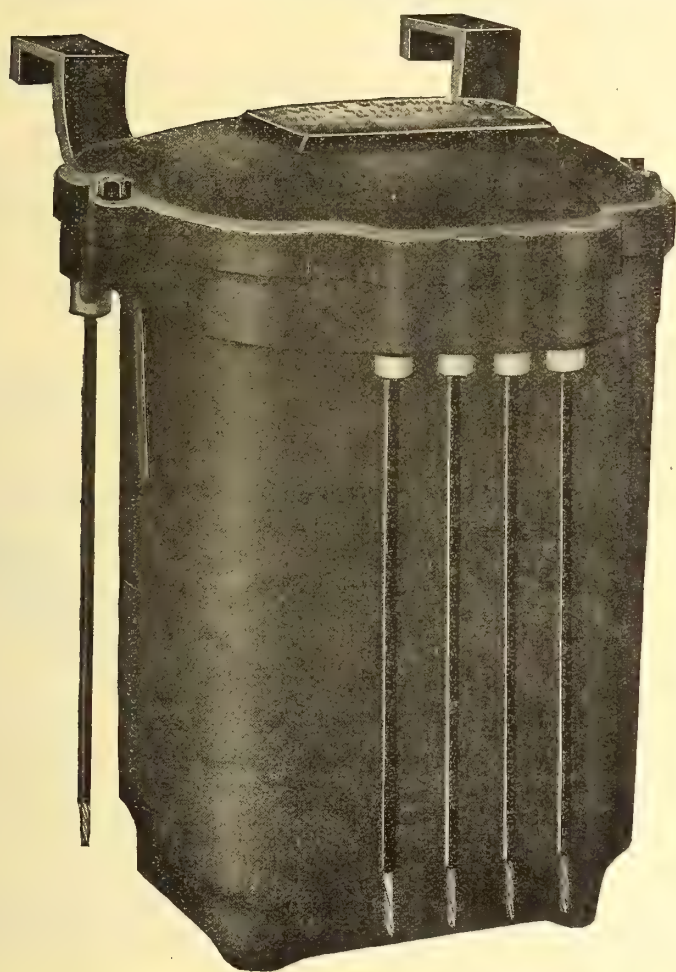
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**The Best Value
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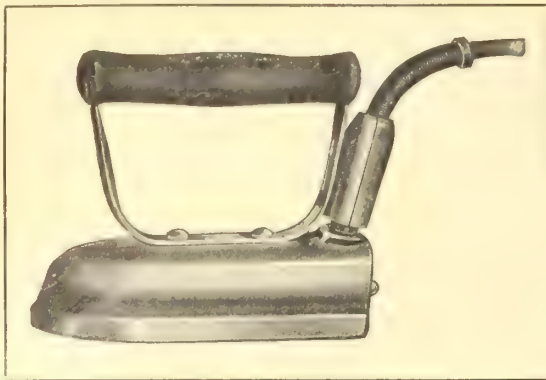
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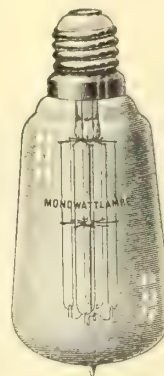
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One watt per candle power in all sizes. Best Quality

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A few dollars spent in advertising your proposals in

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The Chicago (U.S. and Canadian Patents) Conduit Rod Coupling

Best answers the purpose for a device of its kind and the price is right

Used by leading Lighting, Traction and Telephone Companies in the United States and Canada who have recognized its superior construction and adaptability.

This coupling makes a joint that is a joint—not merely a hook connection. Write for descriptive folder and prices.

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The D-P STORAGE BATTERY

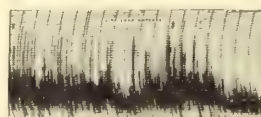
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Line Load. Variation, 0 to 800 amperes.

Generator Load. Fluctuation, 15 amperes either side of mean.

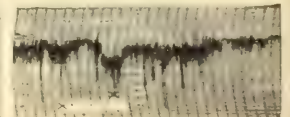
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Line Load amperes.



Generator amperes.



Battery amperes.

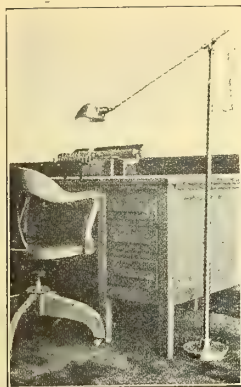
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THE D-P BATTERY CO., LTD., Bakewell, England.

ESTABLISHED 1888.

CODE: A B C, 5th EDITION.

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Adjustable Electric Fixtures

Adjustable into any position and at any angle without the turning of screws or tying of strings.

Desk and Floor Portables, Wall Brackets, Ceiling Bench and Lathe Fixtures

Adjustable Electric Fixtures for Factories a Specialty

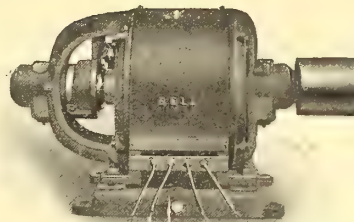
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"BELL" High Efficiency Single Phase Motors

Meet All Requirements



Large stock carried throughout the country for immediate shipment.

Attractive Prices consistent with QUALITY

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RACING COASTER

† The ride which takes the place of an entire park—combines the highest type of construction, maximum earning capacity and minimum cost of operation.

Illustrated Booklet, Dept. C

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Clamps, Insulators,
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Connectors,
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FOR

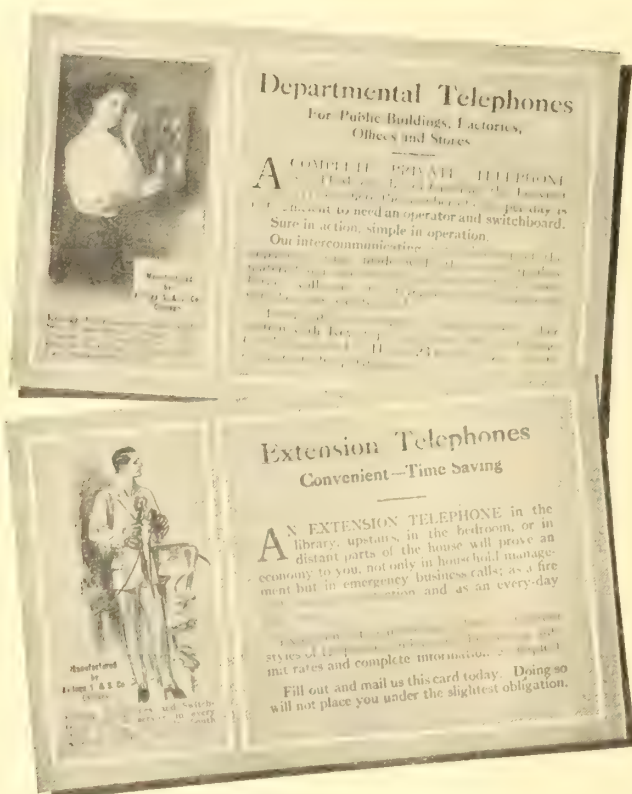
**Bus Bars
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Northern Aluminum Co.

1503-4 Traders Bank Bldg. TORONTO Limited

THE BEST TELEPHONE FOR HARD SERVICE

USED SUCCESSFULLY ON THE HEAVIEST LOADED LINES



THE NEW KELLOGG 5 BAR TELEPHONE (COMPACT TYPE)

This telephone leaves our factory the same day we receive your order; thoroughly tested, complete, ready to put on the wall, the instant it is removed from the strong yet light and secure packing case. Remember Code 2696, standard bridging 1600 ohm ringer, 5 bar generator. Our price is \$10.10, prompt shipments.

Order now—we ship immediately. Every telephone guaranteed from inherent defects for 5 years. Its service record has never been excelled.

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To every telephone man who will install one or more telephones this spring, we say:

If it's the heavy service magneto rural or farm line in which you are interested here is a telephone unequalled at any price for certain signalling, clear transmission, long life.

Code No. 2696 complete (less batteries.)

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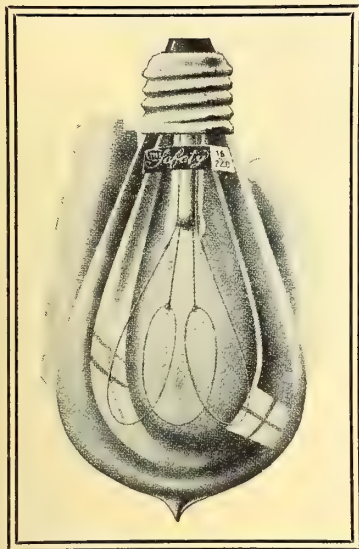
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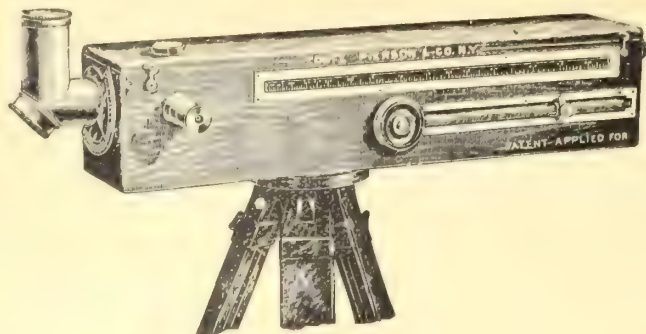
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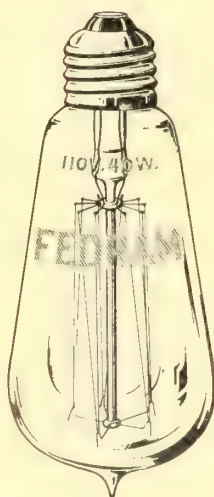
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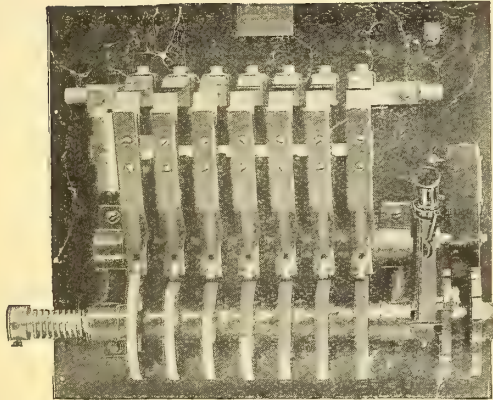
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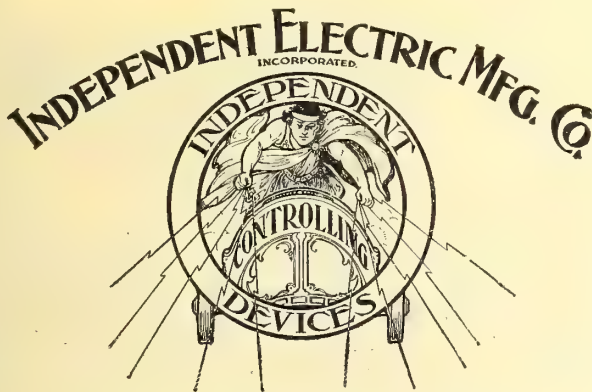
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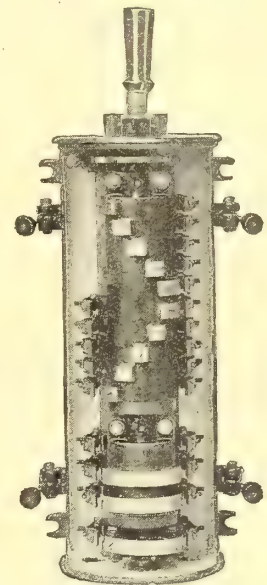
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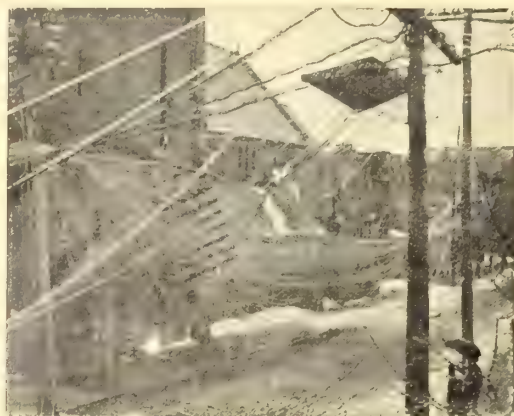
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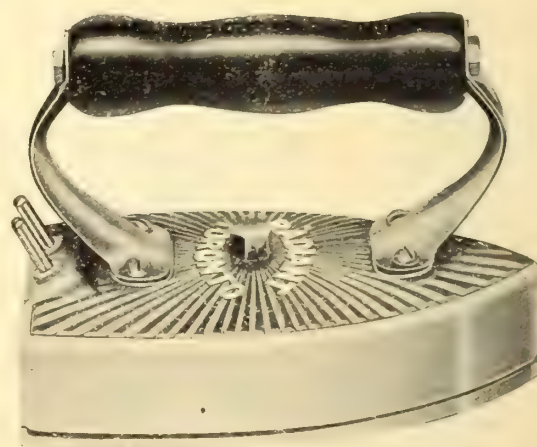
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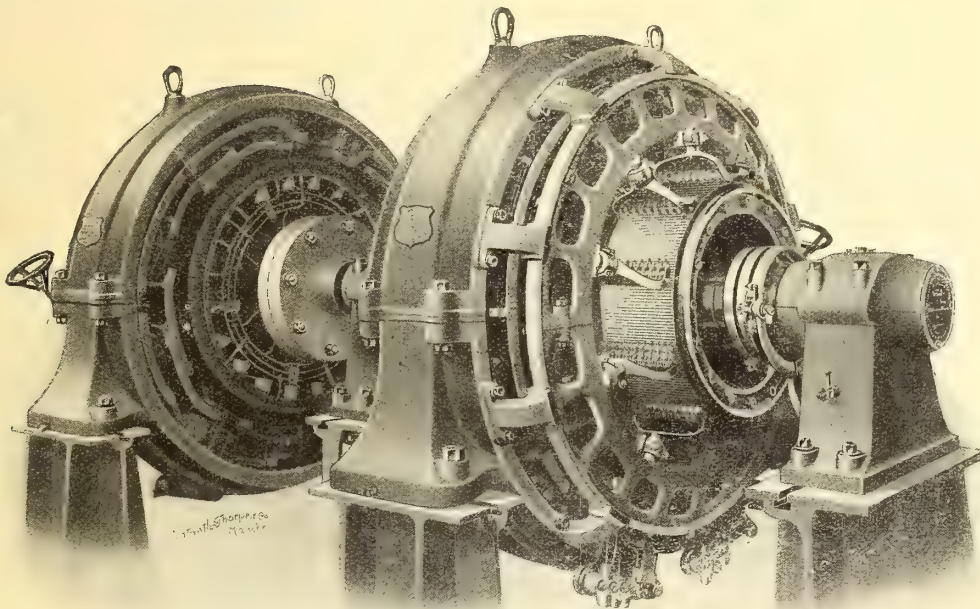
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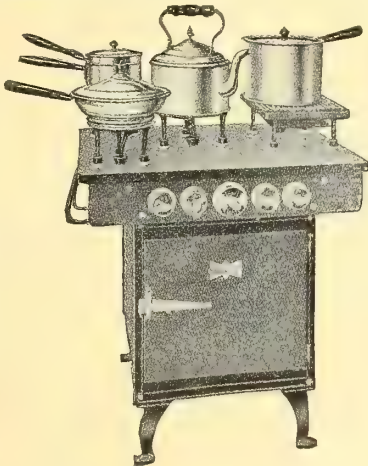
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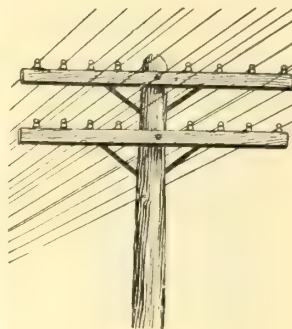
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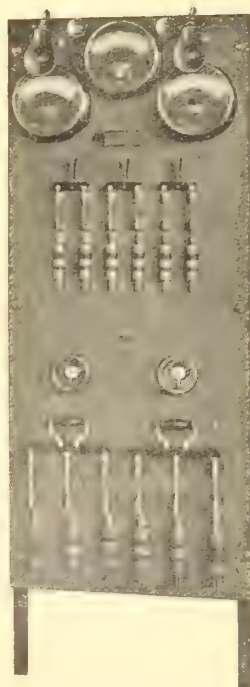
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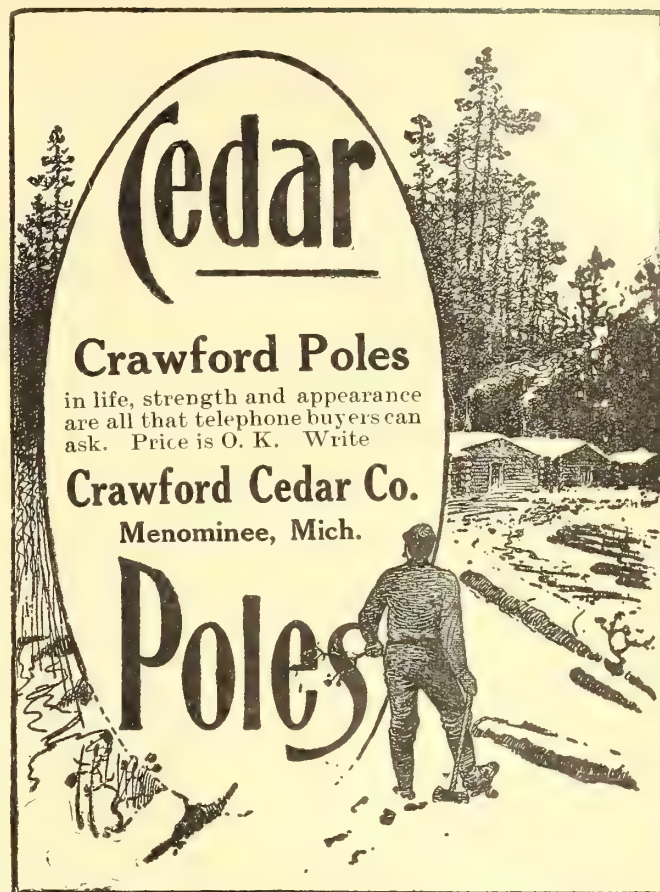
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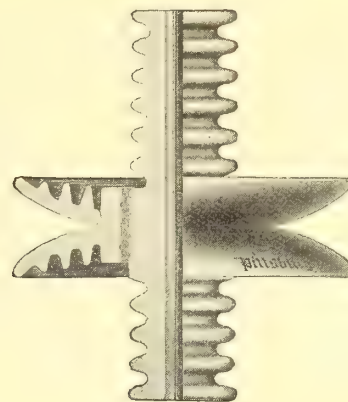
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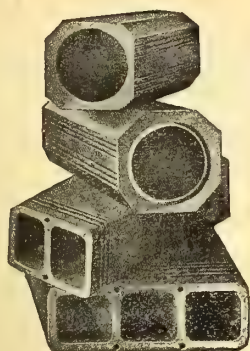
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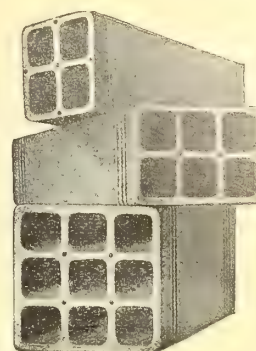
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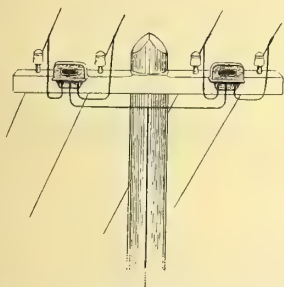
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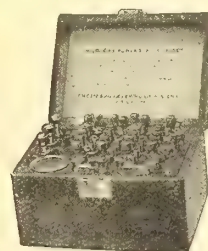
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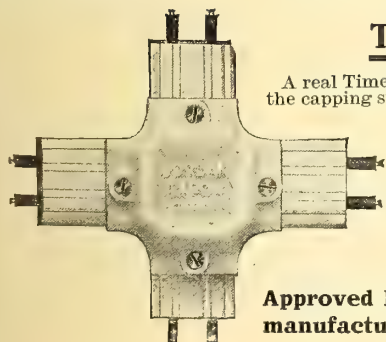
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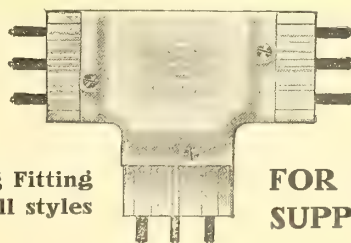
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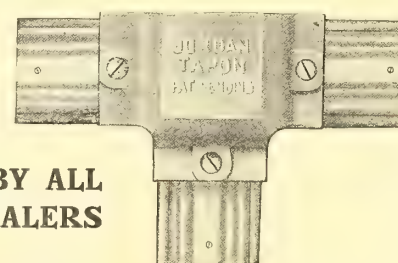
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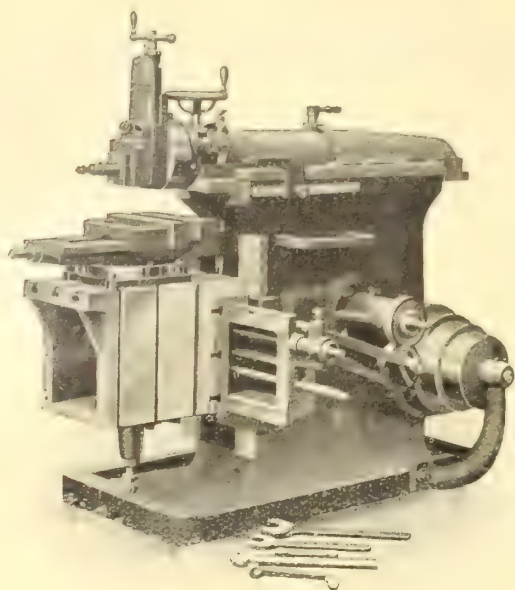
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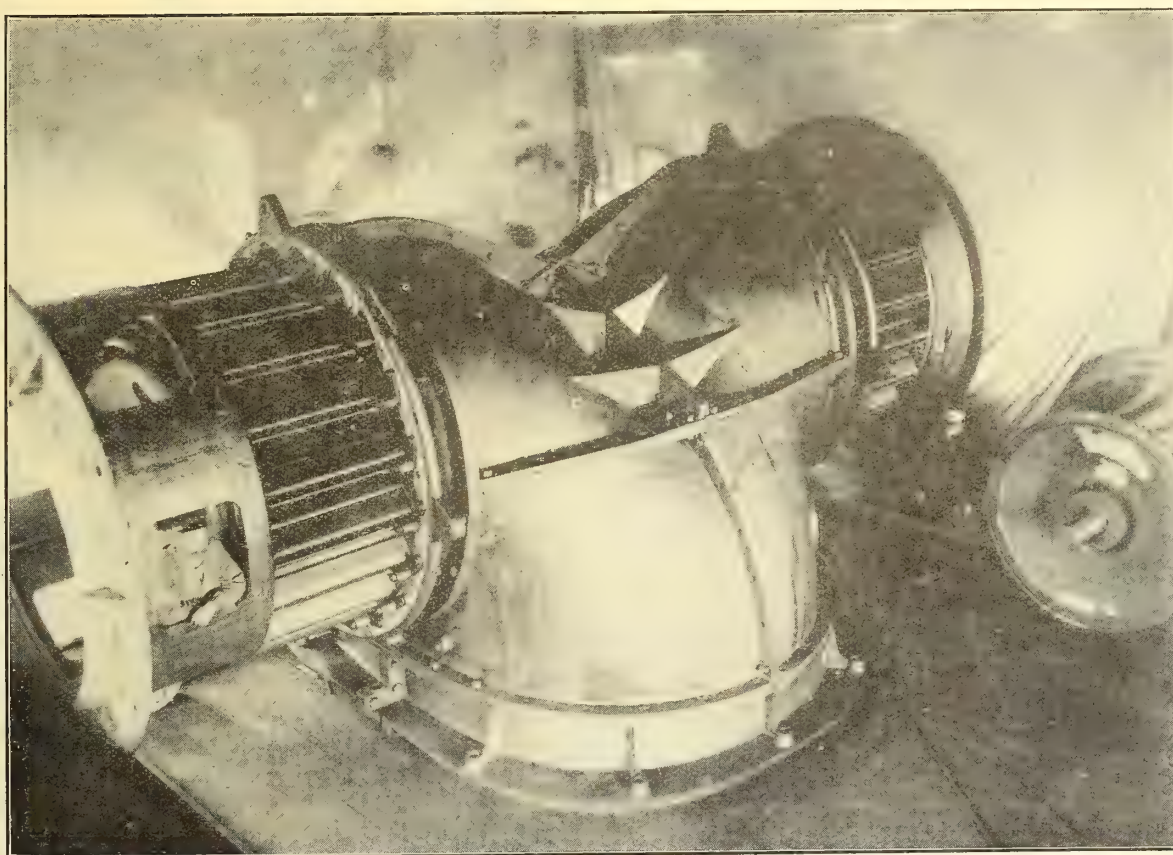
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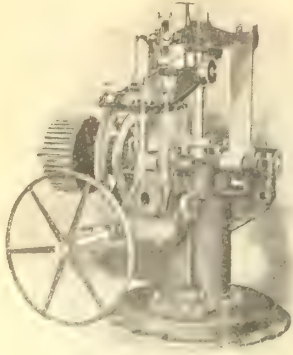
in Open Flumes, operating under 20 feet head at 120 r.p.m. for the POWER HOUSE at DAM NO. 2, TRENTON, ONT., complete with GOVERNORS.



This Picture shows one of the Turbines taken in a horizontal position at the erecting shops. A REPEAT ORDER for Four Similar TURBINES AND GOVERNORS for the Power House at Dam No. 5, Trent River has recently been received.

**WRITE FOR DETAILED INFORMATION TO
164 BAY STREET, TORONTO**

Vancouver Office, 427 Seymour St.



60,000 ft. lbs. capacity

WE MAKE

Water Wheel Governors in 25 standard designs. **Water Wheel Governors** of special design to meet special requirements. **Mechanically Operated Relief Valves** which are absolutely positive in action. **Governors** for large Steam Engines. **Governors** for Large Gas Engines, **Frequency Recorders** for switch-board gallery or office use. **Precision Tachometers** or Speed Indicators. **Long Distance Speed Indicators** for office use. **Speed Recorders.**

We Guarantee All of our Product to be the Best Procurable, and will be glad to correspond with you in reference to any of it.

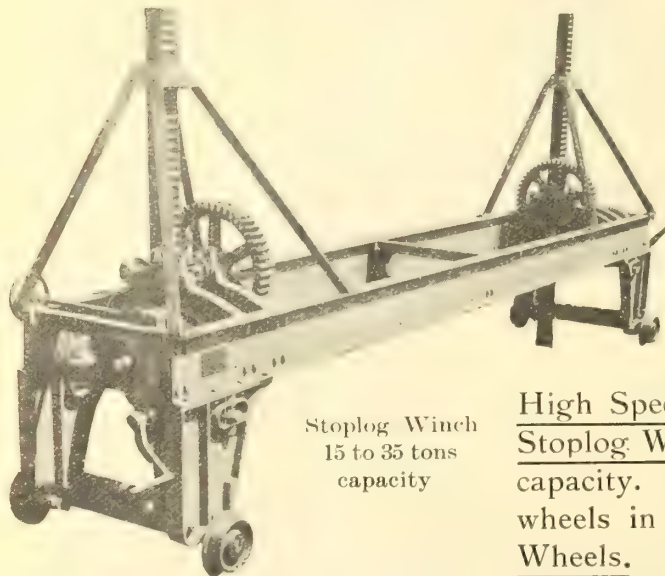
The Lombard Governor Co., Ashland, Mass.

THE

Wm. Kennedy & Sons

Limited

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Stoplog Winch
15 to 35 tons
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Complete Water Power Installations

High Speed efficient Turbines. Headgate & Stiffleg Stoplog Winches, all sizes up to 35 tons pushing down capacity. Heavy Machine Cut Gears, Pulleys, Flywheels in Steel or Iron. Largest Stock Propellor Wheels. Steel Iron and Bronze Castings.

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for Conduit Rods Have Many Superior Features

They are quickly coupled and uncoupled.

They cannot separate while in use.

They may be turned in either direction without unlocking.

They are least liable to get out of order

We believe they are the best couplings on the market. A sample will convince YOU. You have only to ask for it. This Coupon brings sample. We want you to send for it.

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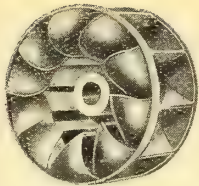
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Bond Co.
391 Atlantic Ave.
Boston, Mass.

Please send sample of Felton Coupling and Catalog. Am interested in Conduit and Sewer Rods. Please quote prices and terms. It is understood that I do not obligate myself in any way to do business with you

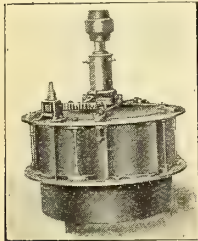
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ELECTRICAL NEWS



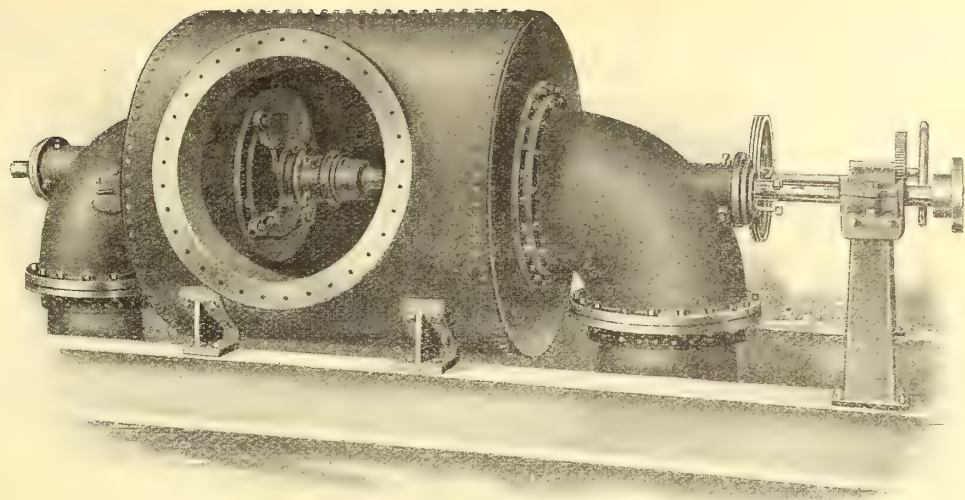
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Our customer for the above turbines writes:-

"The pair of water wheels installed is giving perfect satisfaction under the 70 feet head. I think I have the best outfit for its size in Ontario."

The Canadian Turbine is normal in speed and discharge. No over-rating or over-gating; satisfaction assured.

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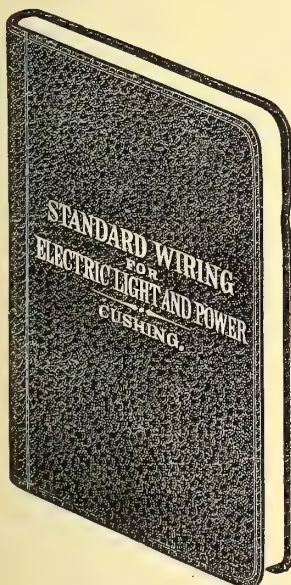
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*Member American Institute of Electrical Engineers; formerly
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1912 Standard Wiring

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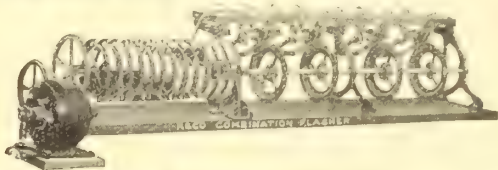
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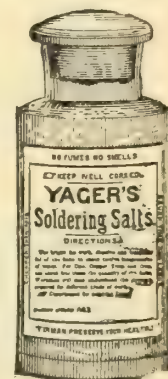
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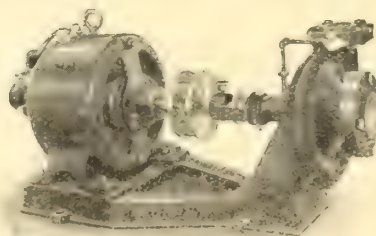
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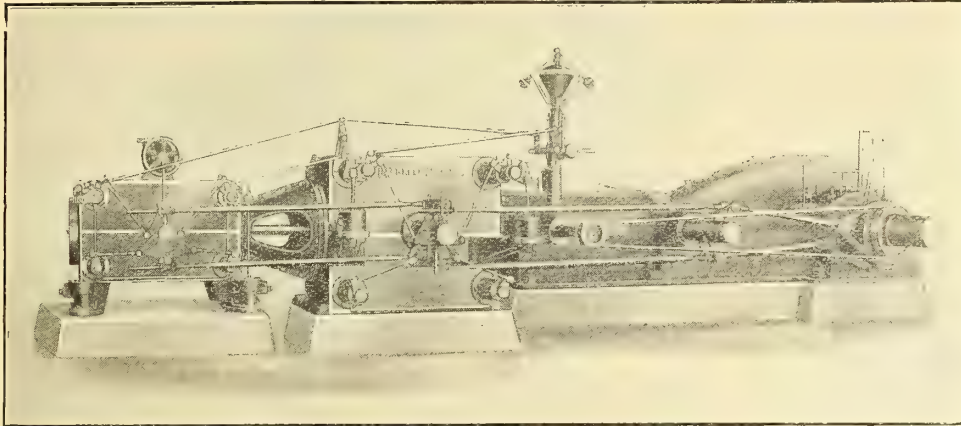


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These engines are
Absolutely Noiseless,
are of **Massive Design**
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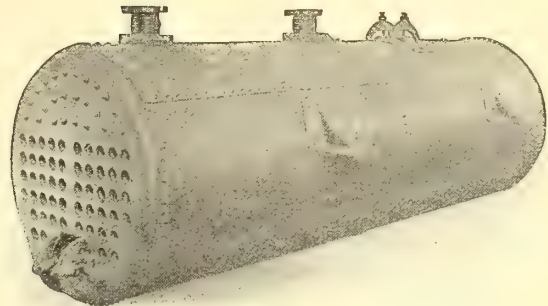
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With boilers designed and built to standard specifications and made to pass the same inspection, it would seem that a boiler built in one shop should be as good as that built in another. It should be—often it is—but just as often it is not.

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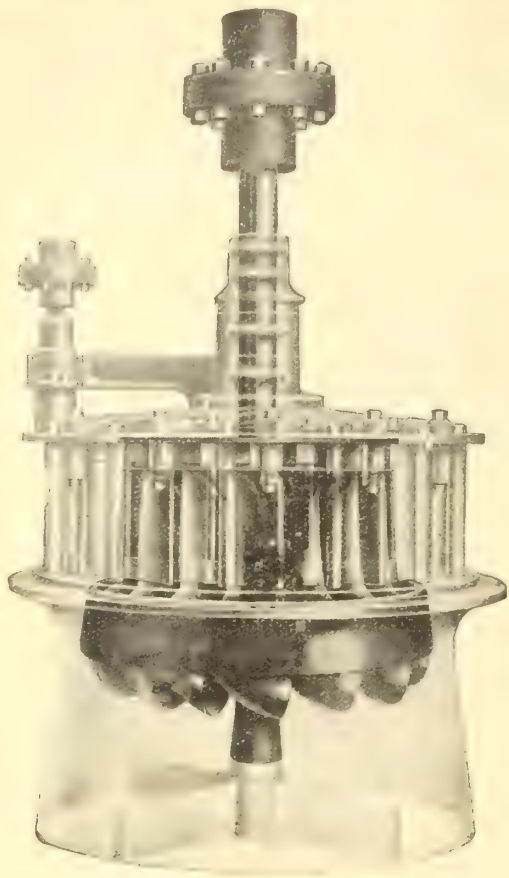
We build all sizes
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The Waterous Engine Works Co.

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Water Wheels of Merit

The SAMSON wheel at official Holyoke tests has reached efficiencies of over 89 per cent. at $\frac{3}{4}$ and $\frac{7}{8}$ gate opening.

The great value of these Holyoke tests is to indicate the possibilities of a turbine; and, therefore, a wheel which shows high efficiencies there is likely to work correspondingly well under actual operating conditions.

And because no other wheel has yet shown such high efficiencies, the Samson is evidently THE wheel for you to use.

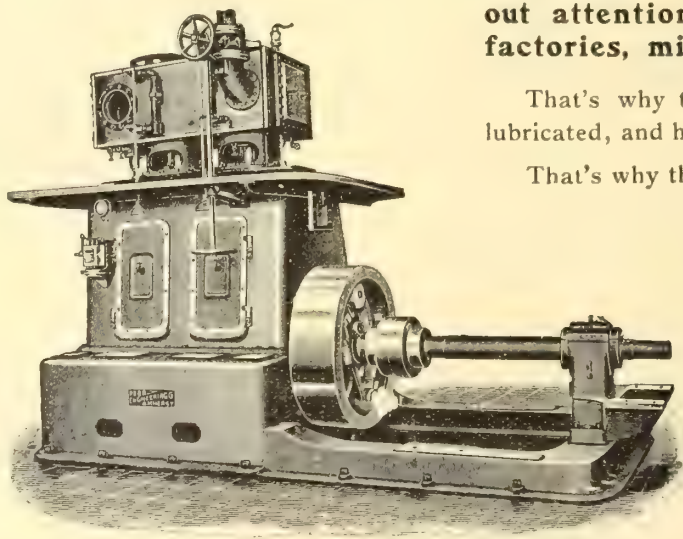
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Robb Vertical Compound Engines

**As
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are built for continuous service without attention and for all kinds of factories, mills and electric plants.

That's why they are enclosed, positively lubricated, and have positive valve gear.

That's why they are single-cylinder or compound, horizontal or vertical, condensing or non-condensing.

You surely can find in our complete line one that will be convenient—it will be reliable because it's a

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ROBB ENGINEERING COMPANY, LIMITED

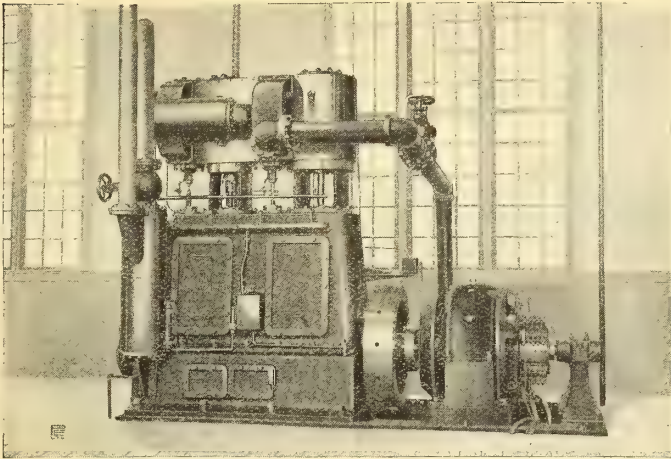
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Vertical High Speed Steam Engines

Especially designed for Direct Connection to Electric Generators.

Economical in Upkeep and in Floor Space required.

Illustration shows one of our Vertical High Speed Steam Engines recently installed.

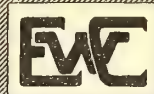
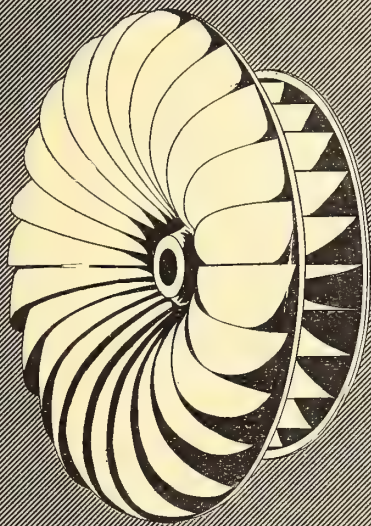
This Engine is 150 H. P. Direct Connected to 100 K.W. Generator.

When Building or Remodelling your Power Plant, be sure to get our Catalogues and Prices on Engines, Boilers, etc. **G. & McC.** Equipment means **STEADY SERVICE ALL THE TIME.**

The Goldie & McCulloch Company, Limited
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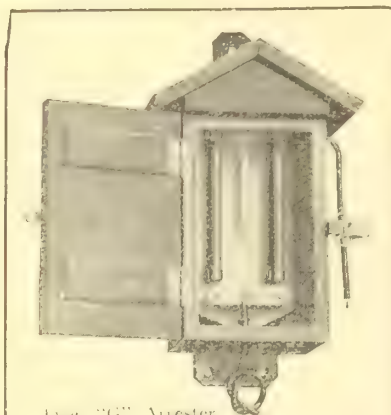


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ESCHER-WYSS

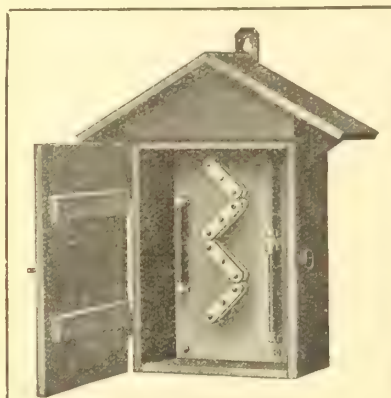
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Every contingency of protective service is provided for by the line of Westinghouse Lightning Arresters



Type "G" Arrester
0 to 2,500 Volts A. C.

These are low priced arresters for outdoor mounting, and are supplied 2, 3 and 4-pole. A set of non-arcing gaps, similar to the C. units, are used in series with a composition stick resistor which is very rugged, but which can be easily and cheaply replaced when necessary. The resistance limits the flow of power current after a lightning discharge, making the arrester applicable on lines of unlimited capacity.



Type "S" Arrester
1,200 to 7,000 Volts A. C.
These arresters will protect circuits the station capacity of which is 2,000 kw. or less. They are small, low equivalent arresters for line use, suitable for single or poly-phase circuits with a voltage between the lines not less than 1,200 nor more than 7,000 volts. They are made in two styles; one 3,500 volts, enclosed in an iron case; the other 7,000 volts enclosed in a wooden case, as illustrated. They are also furnished without cases for indoor use.

Singly, or in combination, they meet every specific requirement.

Conditions, physical and electrical, vary and must be considered when installing protective apparatus.

Our experts, with their wide experience, will be of material assistance to you in choosing just the type, or combination of types, to meet your particular conditions.

Only a few types of arresters are here shown.

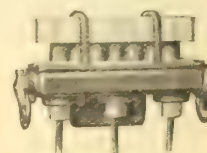
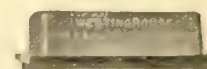
Electrolytic lightning arresters with almost unlimited discharge capacity, are provided for all conditions and all voltages up to and including 110,000.

Remember, the National Board of Fire Underwriters sanctions only approved lightning arresters, and rules that:

"A lightning arrester must be attached to each wire of every overhead circuit connected with the station."

Westinghouse Arresters are approved by the National Board of Fire Underwriters.

Catalogue Sections 443 and 445 describe the full line of Westinghouse Lightning Arresters.



Type "C"
Lightning Arrester
500 to 2,500 Volts A. C.

These arresters consist of a series of gaps between non-arcing metal cylinders. They are the simplest and cheapest to maintain, yet most effective low-priced arresters on the market within their limits of application.

Application may be made at any point on the line when station capacity does not exceed 200 kw. Where station capacity is greater these arresters require certain length of line as a limiting resistance between point of mounting and station.



"M. P."
Arrester
0 to 1,000 Volts
A. C. or D. C. Circuits

These arresters are suitable for either alternating or direct-current circuits, and can be used on a car, on the line or in the power house. They have a practically indefinite length of life and give a freedom of discharge many times greater than other low voltage arresters. The discharge spreads itself over a block of special composition along a number of minute discharge paths; the voltage across each of which is too small to maintain an arc, after a high-voltage discharge has passed.

Canadian Westinghouse Co., Limited, Hamilton, Ontario

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Traders Bank Bldg.	52 Victoria Square	Telephone Bldg.	158 Portage Ave. E.	311 8th Ave. W.	Bank of Ottawa Bldg.

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Quick Thorough Repairs to all makes of Electrical Apparatus.

Remote Control Solenoid Switches for economical tungsten or incandescent street lighting from existing house lighting system.

The Best Carbon Brushes in America for Electrical Machinery.

Used Electrical Machinery of all descriptions.

Let Us Know What You Have For Sale

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162 West Adelaide Street, TORONTO

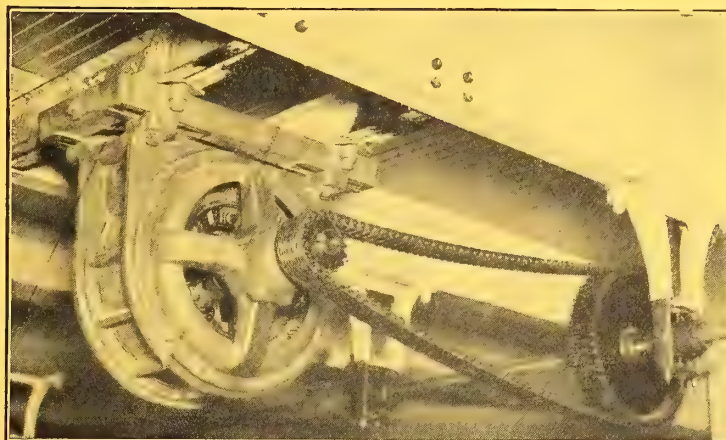
Phone Adelaide 902-903

HANS RENOLD PATENT LINER SILENT CHAIN

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FLEXIBLE



COMPACT

BUT NO

VIBRATION

35 H. P. Motor Bolted to Ceiling

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Above illustration shows one of the Chain Drives in the new works (COMPLETELY EQUIPPED with HANS RENOLD SILENT CHAIN) of one of the **Largest Manufacturers in CANADA.**

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We can KEEP YOU RUNNING while we make your Repairs.

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G & W SPECIALTIES

are the result of 15 years' demands of modern practice. They represent many new and original ideas by practical engineers.

THREE FORMS

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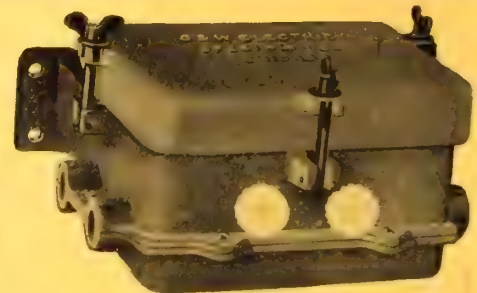
SUBWAY
BOXES



CABLE ENTRANCES

HEADS

SERIES
SWITCHES



Underground low-tension Half-Tap Box.
Cable submerged in compound.

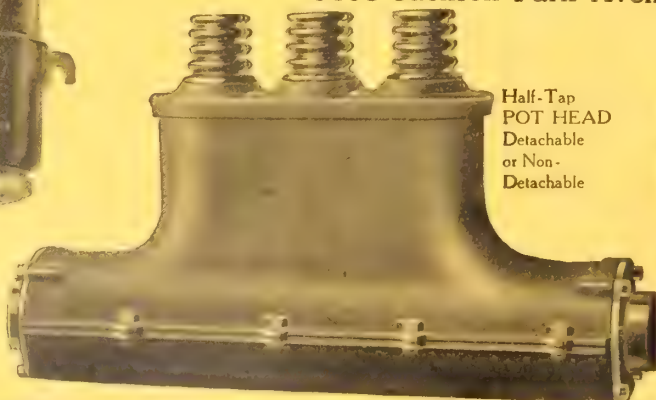
There are numerous installations of G & W Specialties in many parts of the country — in use for over six years. We are in a position to furnish any special type of POT HEAD that may be desired.

G & W Electric Specialty Company

6408 Jackson Park Avenue, CHICAGO, U. S. A.



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for
Catalog
No. 7
Now in
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Half-Tap
POT HEAD
Detachable
or Non-
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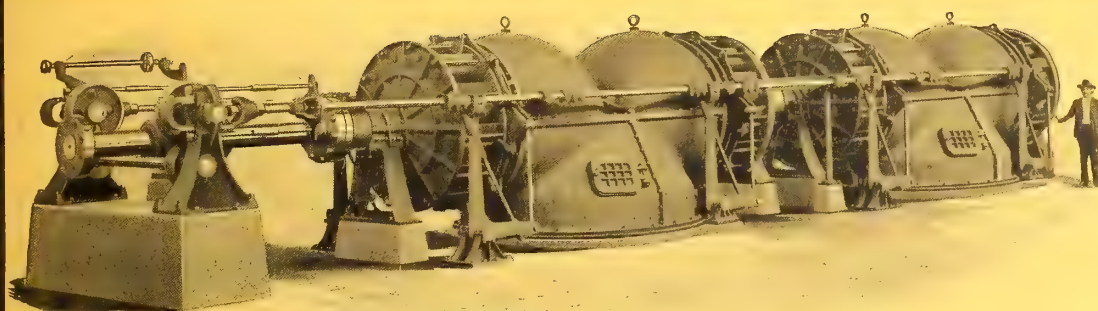


Compound All Around
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Electrical News

Generation, Transmission and Application of Electricity



Hydraulic Turbines

One Unit of Turbines of 3,200 H.P.
30' Head Furnished

J. R. BOOTH,
Ottawa, Canada

Turbines Furnished
for Heads from 5 feet
to 600 feet.

Branch Offices:
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MASS.
American Trust Bldg.,
CHICAGO

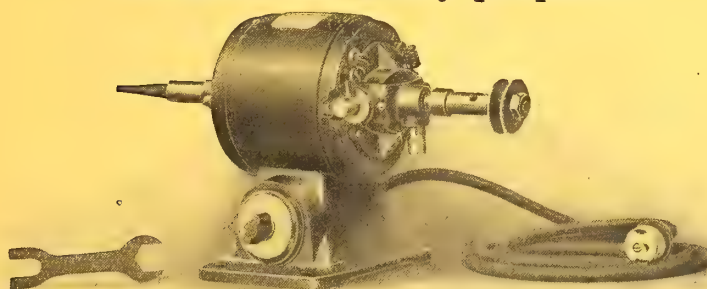
S. Morgan Smith Co., York, Pa.

SMALL POWER MOTORS

Drawn Shell Type

LIGHT WEIGHT, COMPACT AND EFFICIENT

A Motor for every purpose



Jewellers' and Dentists' Buffing and Grinding Outfit

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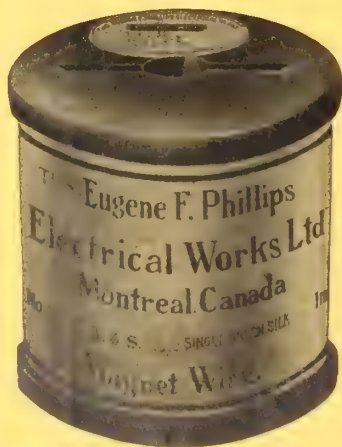
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Bare and Insulated Electric Wire and
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Incandescent and Flexible Cords

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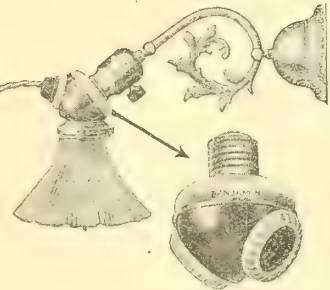
92--PLUG TIME IS HERE--903

SO ARE THE HOT DAYS

OF GOOD OLD SUMMER TIME

SO IS THE USUAL

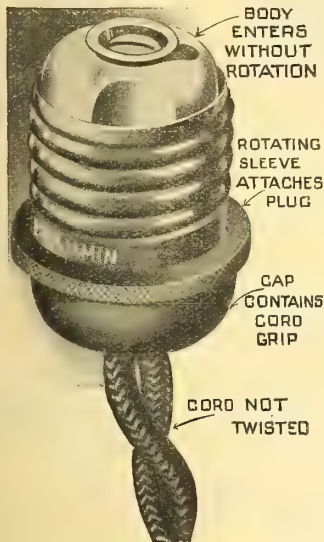
DEMAND FOR FAN MOTORS



CAT. No. 92

Don't

Overlook This Fact



Cat. No. 903

When you Ship

THOSE FANS

See that they are equipped with

No. 903

Attachment Plugs

Easy to attach.
No twisting of cord.
Small—Neat—Unbreakable.
"THE PIONEER AND MONARCH" of all small attachment plugs.

**When You Sell a Fan,
Sell too, a Benjamin
No. 92 Plug Cluster**

How often you have only one outlet available for a fan and that is needed for the lamp. The No. 92 Plug Cluster allows two outlets where there is only one socket.

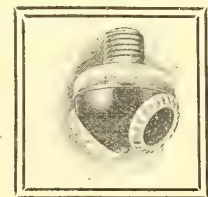
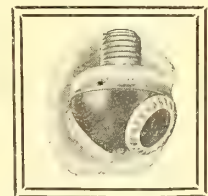
REMEMBER TOO

When you sell that No. 92 Plug Cluster you boost your sales and also your profits.

**Every Fan Buyer Needs a No. 92
He'll Buy it Too, if You Only Show Him**

(Made in 3 Light and 4 Light also.)

YOUR JOBBER HAS THEM IN STOCK



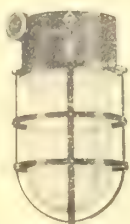
Benjamin Electric Mfg. Co.

64 York Street,

TORONTO, ONT.

Vapor-Proof Condulets—"V" and "VH" Series

Exclude dampness from conduit and protect current-carrying parts from corrosive or explosive vapours. Designed for boats, bath houses, breweries, refineries, etc.



Type "VH" One Side Hub for Dead End.



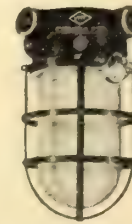
Type "VH" Two Side Hubs for Through Feed.



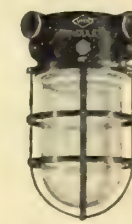
Type "VHL" Two Side Hubs for Right Angle Turn.



Showing "VH" Series Condulets installed in Brewery



Type "VHT" Three Side Hubs for Through Feed and Right Angle Branch.



Type "VHX" Four Side Hubs for Through Feed and Two Right Angle Branches.



Type "VHA" One Top Hub for Dead End.

Condulets of the "V" and "VH" series take any of the several standard receptacles, and are made in six types, each in sizes to fit $\frac{1}{2}$, $\frac{3}{4}$ and 1-inch conduit.

"V" series Condulets accommodate incandescant lamps not exceeding $2\frac{3}{4}$ inches in diameter and 6 inches in over-all length, while "VH" series Condulets, being larger, will mount lamps $3\frac{3}{4}$ inches in diameter and 8 inches in total length.

A complete Condulet of either series consists of a cast iron body, including threaded hub or hubs; a rubber gasket; a heavy glass globe, and a strong, riveted guard.

Metal parts are furnished with either black enamel or galvanized finish to suit purchaser, and while clear glass globes are regularly supplied, the choice of ruby, green, orange, blue or opal glass also is offered.

After globe is adjusted, the guard is clamped on outer surface of casting by means of a combination cam and lever, the cam fitting into a groove in body of Condulet. Eyelets are provided in lever and base ring of guard for accommodation of small padlock, which prevents stealing of lamp.

These and many other types described, illustrated and listed in Bulletin No. 100. Mailed free on request.

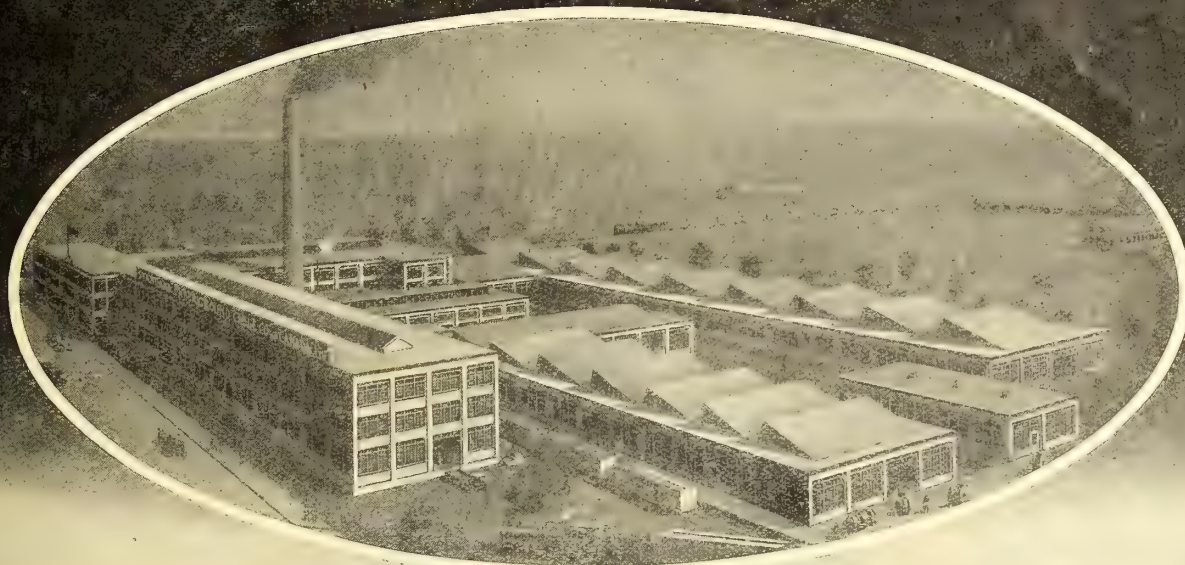
Crouse-Hinds Company of Canada, Limited



MAIN OFFICE AND WORKS
TORONTO, ONT., CANADA



Announcement of the Standard Underground Cable Co., of Canada, Ltd.



Canada's New Industry

On or about May 15th 1912, our new plant at Hamilton, Ontario, will start operation. Our Bare Wire Department will be ready to meet your requirements on that date and other departments will be started as rapidly as possible. Within three months from the above date we expect to have the complete plant running and able to meet, promptly and satisfactorily, your every requirement for the following materials :

Standard Products

Copper Rods
Bare Wire and Cable
Standard C.C.C. Wire
(Colonial Copper Clad)
Magnet Wire
Weatherproof Wire and Cable
Rubber Braided Wire and Cable
Varnished Cloth (Cambric) Cable
Cable Systems Installed Complete

Fibre Insulated Leaded Cable
Dry Paper Leaded Cable
Saturated Paper Leaded Cable
Rubber Lead Covered Cable
Armored Cable
Terminals and Junction Boxes
Splicing Tubes and Compounds
Insulating Tapes and Varnishes
Cable Hangers, Supports, etc., etc.

The rapid growth of the Canadian business of the Standard Underground Cable Co., of Pittsburg, Pa., U.S.A. has required the establishment of a Canadian company, which will employ Canadian workmen. This company will, by close alliance with its associate American company, benefit by its experience of the past as well as future, and will maintain in every respect the high quality of its products as has been done by the latter in its 30 years of successful manufacturing experience.

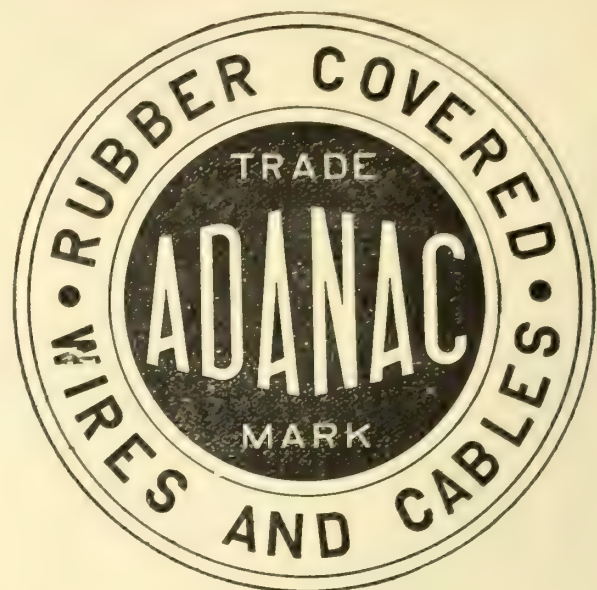
"Standard" products are specified and used by the most prominent and most particular Canadian Engineers, Architects, Contractors and Buyers. Ask a User !

Before you buy get Standard prices and literature. Just mail a card !

Standard Underground Cable Co., of Canada, Ltd.

Dept. E

Hamilton, Ontario



WE MANUFACTURE

Annunciator Wire
 Armature Wire
 Asbestos Covered Wire
 Automobile Wire
 Bare Copper Wire
 Brewery Cord
 Bridle Wire
 Brass Wire
 Bell Cord
 Canvassite Cord
 Copper Steel Wire
 Cable Splicing
 Compound
 Cable Terminals
 Car Wire
 Counterweight Cord
 Deck Cable
 Drop Wire
 Electric Heater Cord
 Elevator Cable

Fixture Wire
 Flameproof Wire and
 Cable
 Lamp Cord
 Lead Covered Cable
 Magnet Wire
 Marine Wire
 Motor Boat Wire
 Office Wire
 Packinghouse Cord
 Pothead Wire
 Paper Insulated Power
 Cable
 Paper Insulated Telephone
 Cable
 Paper Tape
 Portable Lamp Cord
 Pothead Compound
 Etc. Etc. Etc.

Rubber Covered Wire
 Rubber Covered Cable
 Show Window Cord
 Signal Wire
 Slow Burning Wire
 Slow Burning Weather-
 proof Wire
 Switchboard Cable
 Switchboard Cords
 Switchboard Wire
 Telegraph Cable
 Telephone Wires and
 Cables
 Theatre Cable
 Trolley Wire
 Telephone Cords
 Weatherproof Copper
 Wire
 Weatherproof Iron Wire
 Weatherproof Aluminum
 Wire

Send for Catalogue or Specifications covering these lines in detail

Imperial Wire & Cable Co. Limited

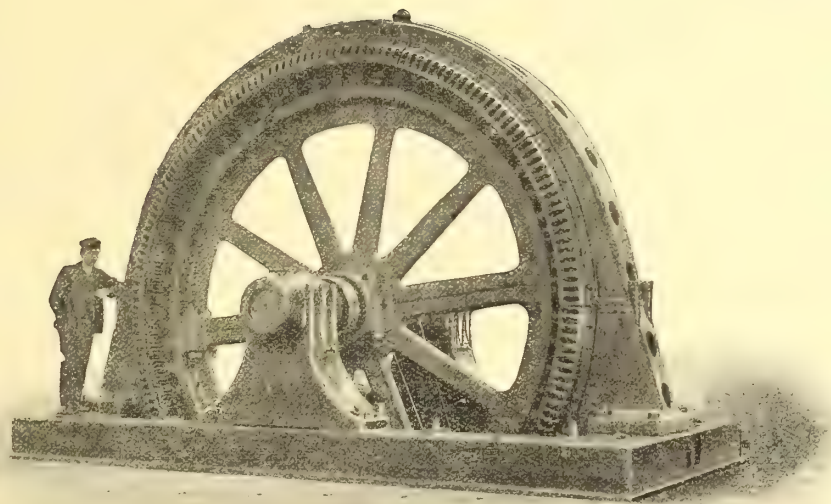
Successors to The Wire & Cable Co., Montreal

THE NORTHERN ELECTRIC AND MANUFACTURING COMPANY LIMITED

Sales Agents: Toronto, Winnipeg, Regina, Calgary and Vancouver

Hydro Electric Power Plant

Slow Speed, Horizontal and Vertical Water
Wheel Type Generators a Specialty



1,250 K.W., 120 r.p.m., 2,400 Volts, 3 Phase, 60 Cycle Water Wheel Type Generator
installed 1910 for the Seymour Power and Electric Co., Campbellford, Ont

Kilmer, Pullen & Burnham,

LIMITED

Head Office,
TORONTO



Branch offices: MONTREAL
General Supplies Ltd.,
CALGARY, ALTA.

SOLE DEALERS FOR

The General Electric Co., of Sweden

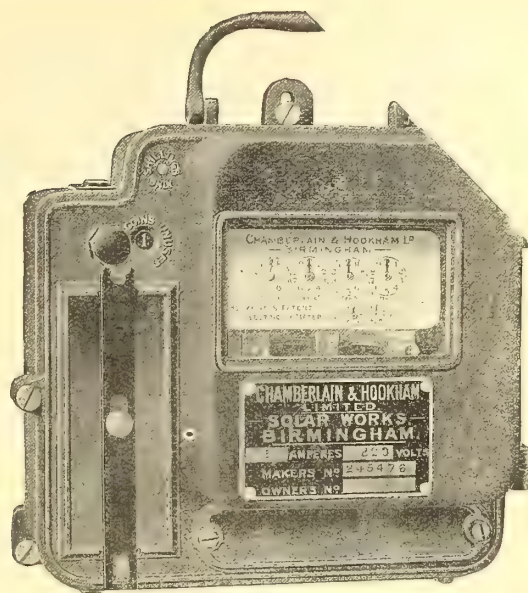
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The Advertisements in the "Electrical News" represent the leaders in their line

Pre-Payment Watt Meters

**RELIABLE
AND
ACCURATE**



The C. & H. Meter Co., Limited

Telegrams, Meters, Toronto

312 KENT BUILDING, TORONTO

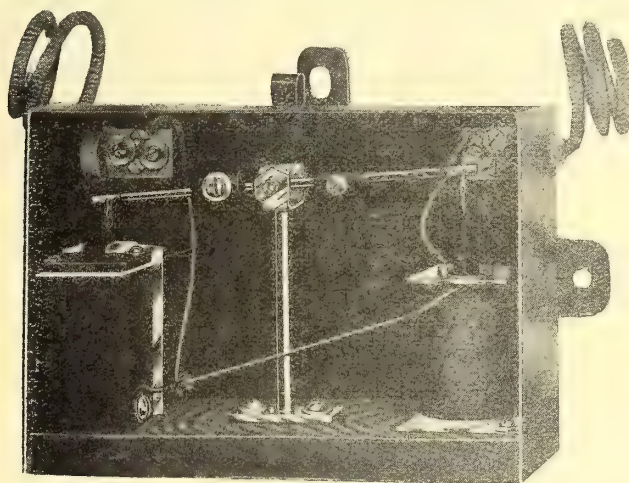
Telephone, 7791 Main

Meter and Time Switch Specialists

Overload Does Not Injure This Controller

THE SHEDRICK ELECTRIC LIGHT CONTROLLER OR LIMITER

Not Made
to
Last a Year
But a
Lifetime.



A
New
Departure
in
Controllers

Result of test of a ten light controller put in circuit with an overload of four lights (fourteen in all) with an average make and break of one hundred and twenty per minute (330,000 strokes)—more than any instrument would be subjected to in a lifetime—showed absolutely no injury in any way to Controller.

SATISFACTION GUARANTEED—WRITE TO-DAY FOR PRICES

Electric Specialties Manufacturing Company
157 Craig Street West, Montreal

“Galvaduct” and “Loricated”

The Conduits that can be Depended
on for Long and Efficient Service



Home of J. C. Eaton, Toronto—A Galvaduct Residence

QUALITY AND DURABILITY

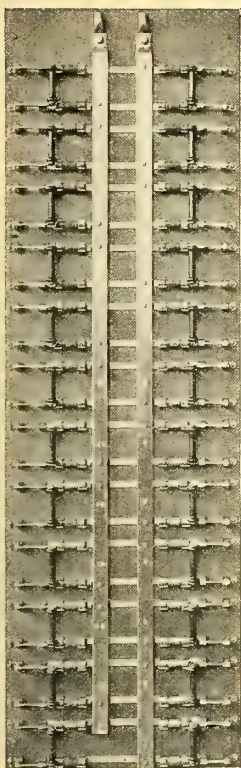
are essential features in Conduits. These qualities are found in the highest degree in “**GALVADUCT**” and “**LORICATED**”.

The work of installing good Conduit costs no more. Besides they eliminate unexpected and often disastrous mishaps.

Always specify the Conduits made by

Conduits Company Limited

Toronto and Montreal



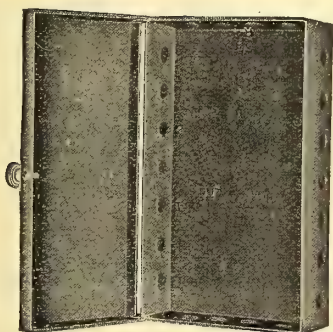
Devoe Panel

Now is the time for you to purchase the material for distributing current into the building you are wiring.

Devoe Panelboards, Cabinets and Switches

will meet every requirement of the most particular purchaser, send us your next order and let us prove it.

The Devoe Electric Switch Company
OFFICE AND FACTORY
157 Craig St. West MONTREAL, QUE.



One Piece Steel Boxes

BETTER MADE and FINISHED
 THAN ANY

Lower Priced

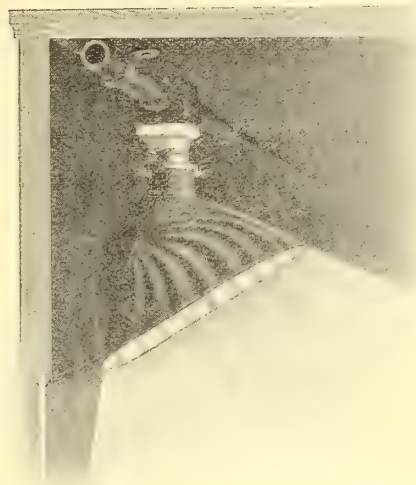
ALWAYS APPROVED

Made Like Natural Wood If You Must Have Wood
WRITE NOW

Columbia Metal Box Co.

PIONEERS

226-228 E. 144 St., NEW YORK



THE SCOOP

Look Around You

and you will find that a great majority of the best show windows are equipped with X-Ray Window Searchlights.

WHY ?

Because they produce **better** results at **less** cost than can be obtained by any other method.

Scientifically designed and plated with pure silver, they direct all the light on to the goods displayed.

Simple to install and easy to keep clean.

Three styles; the Scoop, the Helmet and the Poke Bonnet, for windows of any proportion.

Ask for catalog and copy of our booklet "Efficient Show Window Illumination."



**The Eye Comfort
System of Indir-
ect Illumination**



is lending its charm to Churches, Theatres, Hospitals, Offices, Stores, Residences, etc. Get your share of this business.

**National X-Ray Reflector
Company**

220 Jackson Blvd., CHICAGO, ILL.

Public Service Corporations

desiring to finance their needs by the sale of Bonds are requested to communicate with us.

We deal extensively in the bonds of Hydro-Electric Power Companies, Electric Railways, Gas Companies and Electric Lighting Companies which meet our requirements.

E. H. Rollins & Sons

Investment Bonds

200 Devonshire St.
Boston, Mass., U. S. A.

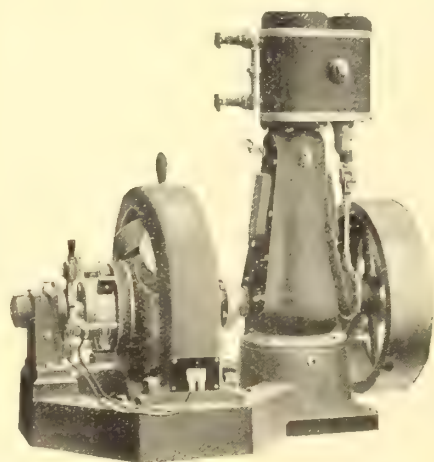
**We Purchase Outright
entire issues of bonds
on steam and elec-
tric railroad, gas,
electric and
hydro-electric
properties**

N. W. HARRIS & CO.

Established 1882
Incorporated 1911

35 Federal Street, Boston, U.S.A.

EFFICIENCY



By Efficiency in a Generator we mean one that will give you maximum output for the least expenditure of driving energy.

**Toronto & Hamilton
Electric Company**
Hamilton, Ontario

Electrical Supplies of every Description

A few of our specialties :

**Moloney High Efficiency Transformers
Carbon and Tungsten Lamps
Rigid and Flexible Conduit
Condulets**

Large stock ; prompt shipments.

Write for new and complete catalogue No. 3.

**Central Electric & School
Supply Co., Limited**

36 Adelaide St. West, Toronto

Quality and Service Did It



XCELL Batteries contain 29% more than the standard measure of electrical energy in primary batteries. That is the reason for the enormous increase in demand throughout Canada, England Australia and India.

Canadian Carbon Co.
Limited

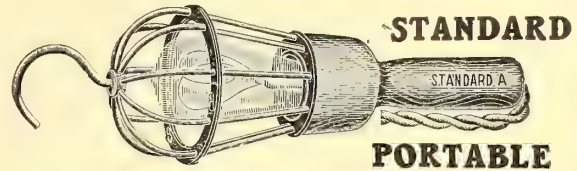
96 King St. West, Toronto

McGill Portable Lamp Guards

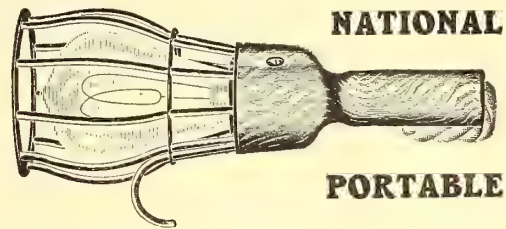
enable lighted incandescent lamps to be safely carried to dark corners within reasonable distance of a lamp socket.

Convenient Economical Safe

Thousands in daily use in Mills, Factories, Warehouses, Garages, etc.,



A substantial, serviceable portable with W.P. Socket; has been a popular seller for years; always dependable. For 16 and 32 C.P.



Here is the best medium priced portable ever offered. Well made, very strong and will stand hard knocks and give long service. For 16 and 32 C. P.

Write for net prices on these portables; also for catalog which shows many other portables, Lamp Guards and Electrical Specialties.

McGill Guards and Specialties carried by most Canadian Dealers.

McGILL MFG. CO.

5 OAK ST., VALPARAISO, IND.



Largest Exclusive Electrical Supply House in Western Canada



We Cover NORTHERN ONTARIO, MANITOBA, SASKATCHEWAN and ALBERTA. Advise us by post card and we will have our traveller personally call on you.

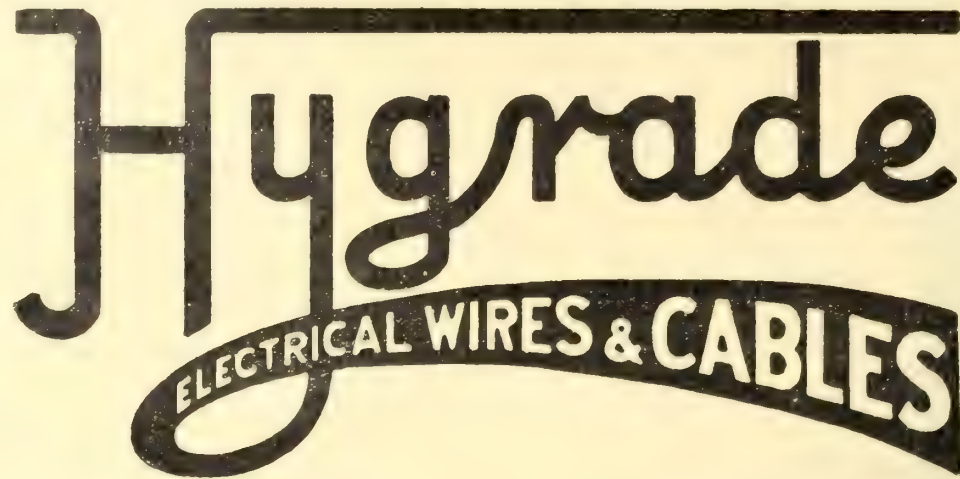
All lines of standard electrical material carried in Winnipeg stock. PROMPT SHIPMENTS, STANDARD PRICES, COURTEOUS TREATMENT. If you are NOT a customer, you SHOULD be. It will pay you as well as ourselves.

Write for our new 1912 calendar.

The James Stuart Electric Co.

324 Smith St., Winnipeg, Man.

Limited



Copper Aluminum Iron

Weatherproof Insulated and Bare

For
Telegraph, Telephone, Lighting
Power and Street Railway Circuits

Galvanized Steel Strand for Guys

Canada Wire & Cable Co.

Limited

Eastern Sales and Warehouse
141 St. Peter Street, MONTREAL

Head Office and Factory
1160-1170 Dundas Street, TORONTO

Rush Jobs

The quality of insulation used on hurried repairs is more important than in ordinary work, because the danger lies right there—in the hurry. If time is precious, material should be the best.

For those quick splices the best is
"A" SPLICING COMPOUND.

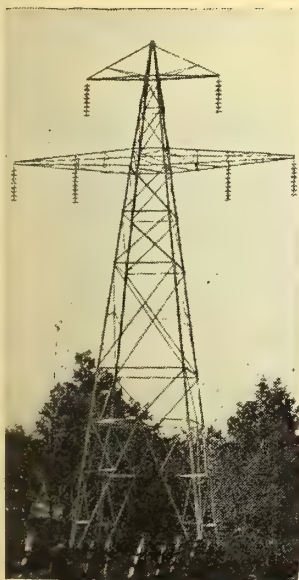
Walpole Rubber Co. Limited
MONTREAL, CAN.

Liquid and Rubber Insulation

American Co.—MASSACHUSETT CHEMICAL CO.
Walpole, Mass.

Pioneers in Insulation Engineering

TRANSMISSION TOWERS



Hot Galvanized or Painted

Estimates furnished on
application

**The Canadian
Bridge Co.**

Limited

Walkerville, Ontario, Canada

MANUFACTURERS OF

**STEEL RAILWAY AND
HIGHWAY BRIDGES**

Structural Steel of all kinds

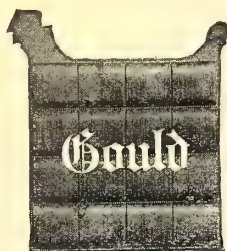
DOUBLE CIRCUIT TOWER
One of 3,300 Towers furnished for the 300 mile Transmission Line of the Hydro Electric Power Commission of Ontario. Transmitting a 110,000 volt current from NIAGARA FALLS to the principal cities of ONTARIO. The largest single order of Transmission Towers ever placed.



No Power Proposition is too big for Gould Batteries

These Gould Storage Batteries are essential factors in permitting the Detroit Edison Company to profitably furnish to the Michigan Central R. R. power for the Detroit River Tunnel trains. This work involves variation from practically no load to 5500 kw. for from four to ten minute periods at irregular intervals throughout the whole day. It also demands the *utmost reliability and protection against delay of trains*. Only by the installation of Gould Batteries and special forms of Gould Regulating Apparatus could the railroad company be assured of a degree of reliability and close regulation of incoming power that would permit taking advantage of the Detroit Edison Company's service and entering into a mutually advantageous contract.

The Gould Batteries and Regulating System in this instance enabled the central station to furnish power on far more advantageous terms than possible by building and operating a private plant. Similarly, proper installation of Gould



Batteries offers opportunities for any central station in the furnishing of power for electric railways, electrified terminals, large shops and factories, rolling mills and other industrials with large power demands.

Our engineers are always ready with free advice on such subjects.

Gould Storage Battery Co.

General Offices: 341-347 Fifth Ave., NEW YORK

Works: DEPEW, N. Y.

BOSTON, 89 State St. CHICAGO, Rookery Bldg.

SAN FRANCISCO, Atlas Bldg.

CLEVELAND, American Trust Bldg.



Crocker - Wheeler

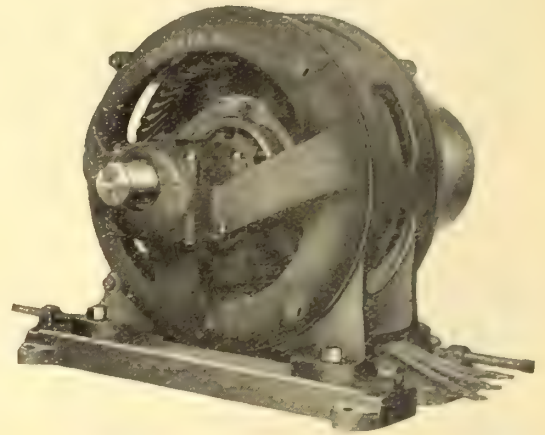
Standard Induction Motors

Are Built to Work

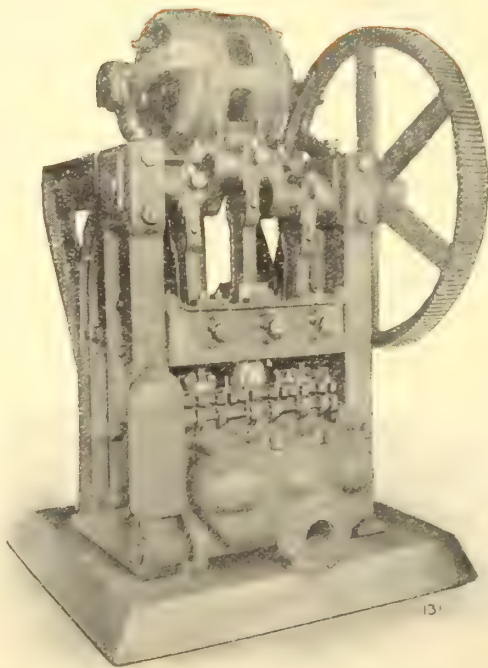
THEY HAVE

Large Shafts
 Lumen Bearing Journals
 Dustproof Bearings
 Ideal End Ring construction
 Rugged Stator Frames
 Open Stator Slots with
 Metallic Coil retaining wedges.

and **ADJUSTABLE AIR GAP**



**THEY RETURN TO YOU THE GREATEST
 PROFIT ON YOUR INVESTMENT**



BECAUSE THEY

Are readily adapted to meet special
 requirements of drive and service.
 Have high power factor
 Have high efficiency
 Have large overload capacity

ARE BUILT IN CANADA

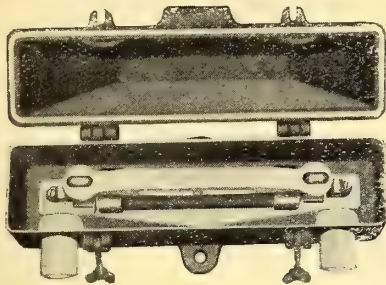
Canadian Crocker - Wheeler Co.

Manufacturers and Electrical Engineers

LIMITED

HEAD OFFICE AND WORKS: ST. CATHARINES, ONT.

BRANCH OFFICES: MONTREAL, QUE.
 VANCOUVER, B. C.



"Noark" Type "E" Service Box
2500-Volt; 1 to 30 Amperes

"NOARK" Service Boxes

Insure Ideal Protection for Transformers

These boxes are substantially built of iron and can be secured to cross arms by means of four wood-head screws through outside feet.

The cover is securely closed by two pivot studs with wing nuts and may be sealed, rendering it fool-proof.

The cut-out is amply protected by the iron box and has a base of porcelain. The porcelain base is absolutely weather-proof.

The base is mounted on two bosses (just off center) which gives the greatest possible leakage surface by surrounding it with air.

All contacts are of the well-known "Noark" thimble-lug type, making perfect contact.

A porcelain fuse carrier handle is provided and has brass-plated steel clips with snap latches which lock under fuse blade and cannot be opened by accident. In inserting a fuse, it is first locked in carrier and thus placed in contact clips. The operator is protected from contact with live metal parts by this means. Each box is figured with a very high factor of safety for both spacing and leakage, thus guarding against break-downs from surges on the line. The fuses are designed to open a short circuit at 5000 volts, but are rated and intended for use on 2500-volt circuits.

Every box is tested at 400% overload or at a potential of 10,000 volts before shipment.

Write Nearest Branch for Full Particulars.

The Canadian H. W. Johns-Manville Co. Limited

Manufacturers of Asbestos
and Magnesia Products

ASBESTOS

Asbestos Roofings, Packings,
Electrical Supplies, etc.

TORONTO, ONT.

MONTREAL, QUE.

WINNIPEG, MAN.

VANCOUVER, B.C.

Monarch Electric Company, Limited

St. Lambert, P.Q.

DISTRICT MONTREAL

Phone: Main 3988
Montreal Exchange



500 Amp. 6,000 Volt Automatic
Oil Circuit Breaker Laminated Con-
tacts Individual Oil Tanks. Can be equip-
ped for remote control.

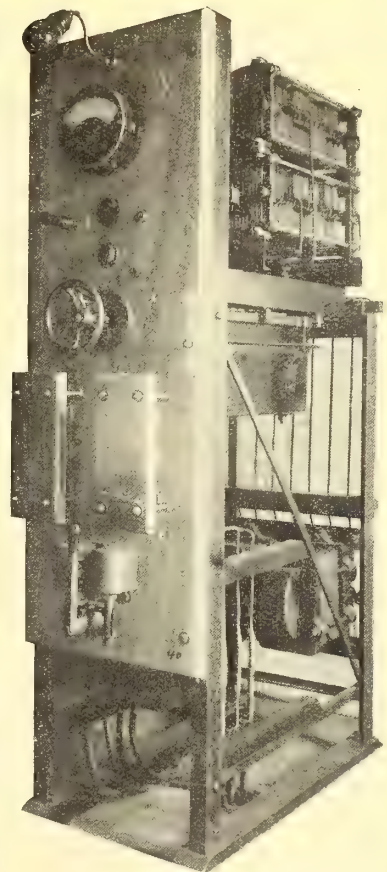
We
manu-
facture

Electrical
Specialties,
Switchboards,
Switches

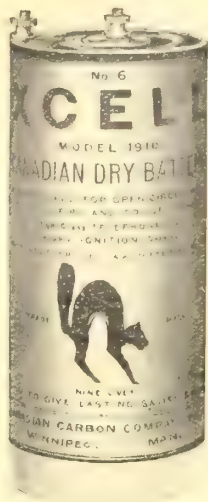
Special Transformers

and numerous other Electrical Ap-
pliances but space prohibits enlarging
on them in this issue.

300 H.P. 2500 VOLT MOTOR STARTING EQUIPMENT



Western Trade Prefers a Battery Made in the West



We have built up a demand for our batteries that is increasing week by week. Our advertising campaign covers Western Canada. Once it induces a consumer to try

X CELL DRY BATTERIES

the work is done, for—

We are making a battery that's hard to equal and impossible to exceed. "Once a user, means always a user." To dealers it means no "dead" shelf stock.

Order from any Western jobber or write the factory direct.

Canadian Carbon Company, Limited
Bury and Irish Ave., WINNIPEG

Tool Troubles and You will be strangers if your equipment is stamped



This mark means quality and improvements that **SAVE TIME, MONEY and TROUBLE.**

Let us prove it to you.

All important dealers have them.

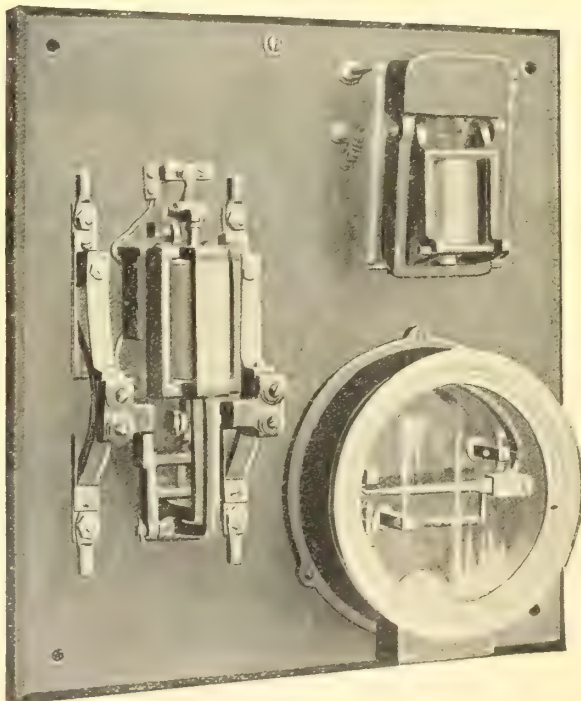
Oshkosh Mfg. Company

So. Main

Oshkosh, Wis.



SUNDH PRESSURE REGULATORS



For use in starting A. C. and small D. C. Motors.

Specially designed for installations where they can be thrown across the line without the use of starting resistance. Compact and reliable and will not get out of order.

When the amperes taken by motor exceed the 10 amp. capacity of the magnet switch, a switch of large capacity is added, the magnet switch acting as a relay.

We manufacture a complete line of controlling devices such as Motor Starters, Pressure Regulators, Tank and Sump Switches, Panels, etc.

Send for Catalogue.

Sundh Electric Company

New York, U. S. A.

"BRAIDUCT"

is covering the Dominion like dew - you can see it everywhere

"Braiduct"

is made in Canada by Canadian labor and Canadian raw materials, and no expense or skill is spared to produce, absolutely the

Best Flexible Conduit

ever made.

Approved and Listed by the Underwriters' Laboratories Inc.

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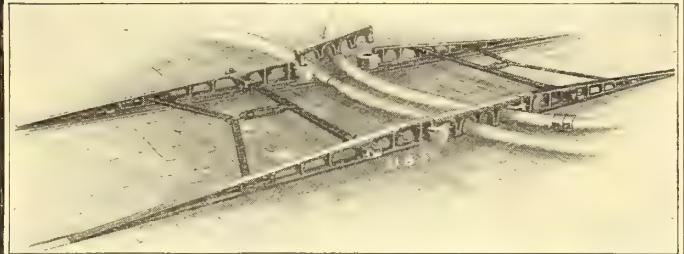
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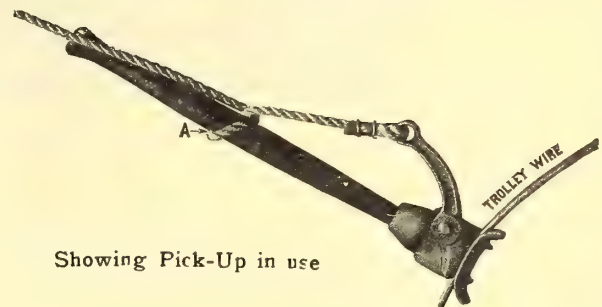


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Can you afford to run the chances of a fire blockade at morning, noon or night when your cars are carrying the peak of the load—when they are earning the most money for you?

Blockades caused by fire hose across your tracks can be eliminated by having an O-B Hose Bridge on each repair wagon. It will carry the heaviest cars over several lines of hose and can be set up quickly. The money lost by one delay would probably equip your entire system. Investigate.

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Showing Pick-Up in use

Note carefully that the "half-hitch" is not produced by winding the rope entirely around the handle, but the ropes pass thru a hole in the handle at point marked "A."

The wire being at a right angle to the handle of the Pick-up keeps the end of the wire away from the hands.

The groove, the cam-lever and method of gripping the wire all tend to render the device fully as effective upon a worn 1-0 wire as upon a 4-0.

It is furnished regularly with 50 feet of rope, wound neatly about the handle, so that one can very readily be carried in each car if desired.

Let us send you one upon trial, or for inspection.

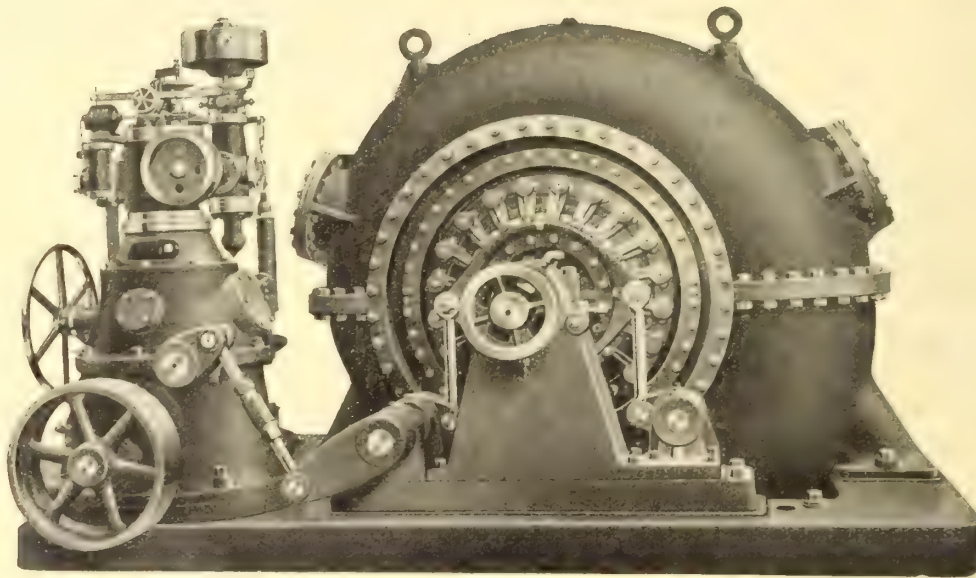
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Governor and Outside Gate Rigging

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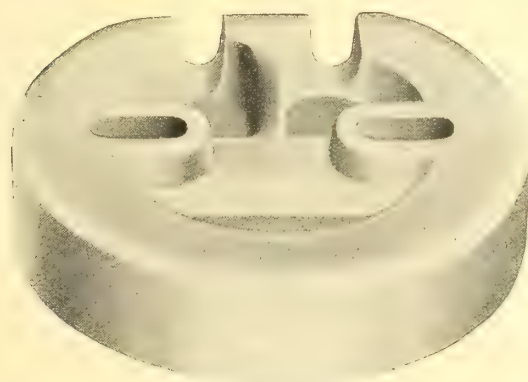
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Switch Base

is especially designed to hold the switch in an **upright** position so that the tumbler works **up and down**.



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Notice the neat design,—away ahead of the old style and made of the very hardest grade of porcelain we can procure.

In cases of 200 at six cents a base list.
Liberal discounts to the trade.

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Duncan Electrical Co.
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Now is the Time to Place Your Contracts for Fans



60" Ceiling Fan

We have in Toronto a complete stock of the famous MARELLI FANS, and are well equipped to fill your orders for both A. C. or D. C. Fans.

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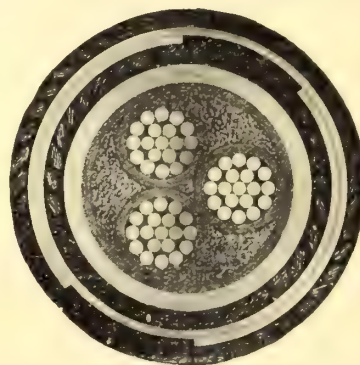
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Paper Insulated
Lead Covered
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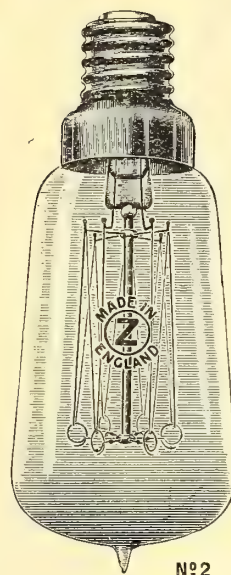
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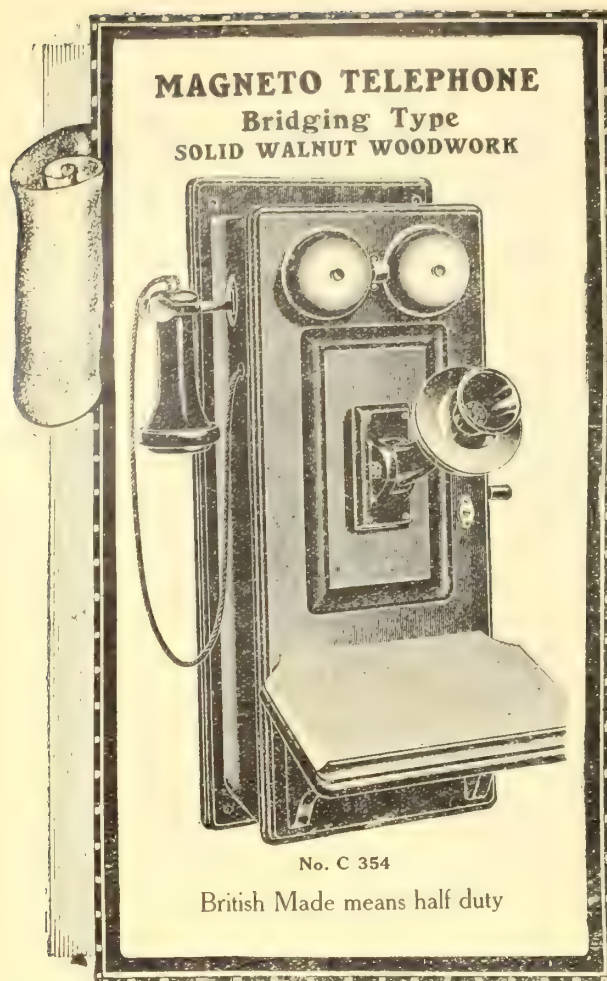
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For Factory and Mill Work
where open wiring is desired
"Sterling" conduits afford the
highest type of fireproof Install-
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For Wiring Old Buildings
they avoid the necessity of tear-
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they overcome the difficulties of
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Has exceptional advantages for classes of work as here-
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**Easy to Install. Neat in Appearance.
Lasting in Wear.**

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"Sterling" Flexible Steel Conduit and Armoured Con-
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We carry a large and well assorted stock of Conduit,
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they make it possible to safely
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with their protecting coat of zinc,
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installations make a permanent
job.



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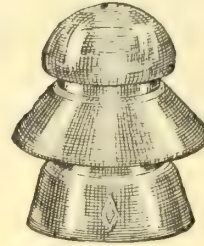
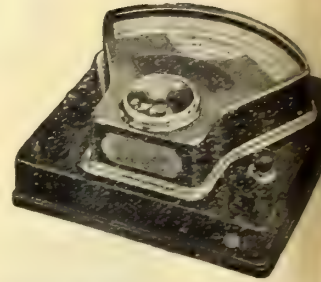
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THE WIRE & CABLE COMPANY

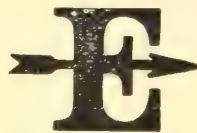
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REGISTERED APRIL 2, 1901
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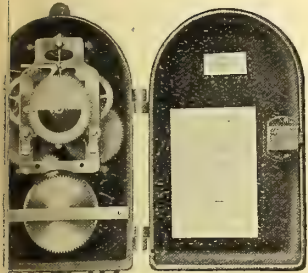
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(Reg. U. S. Pat. Off.)

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Two Million and Seventy One Thousand Three Hundred
Candle Power of
**Sunbeam Carbon and Mazda
Drawn Wire Tungsten Lamps**



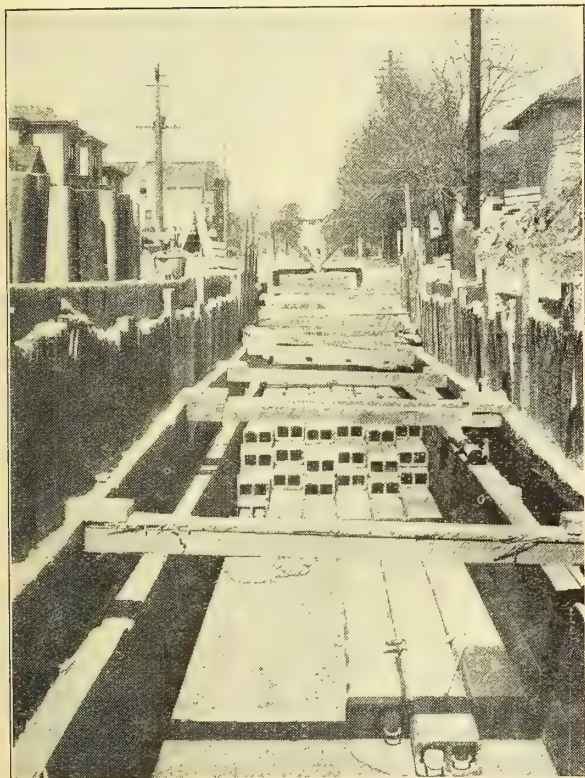
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Turbo-Alternators, Rotary Converters, Motor-Generators

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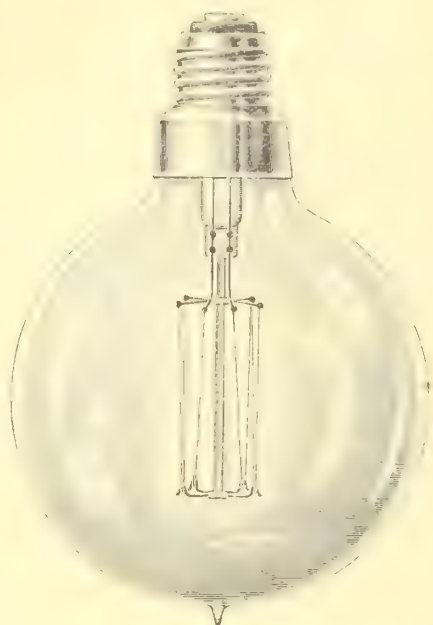
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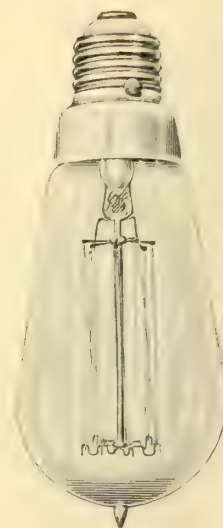
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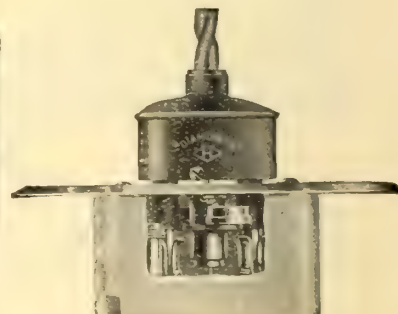
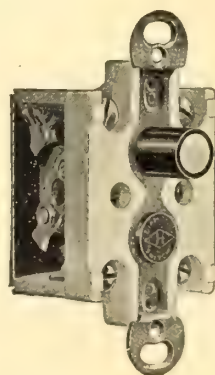
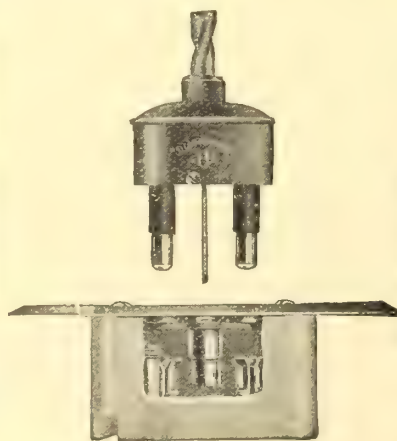
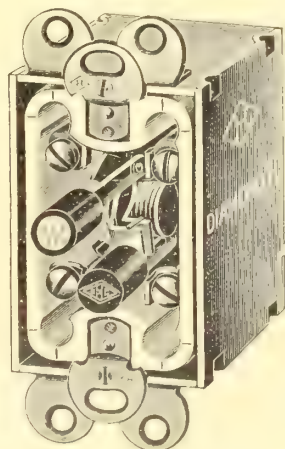
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Protect Your Investment in Switches by Specifying "Diamond H"

The best protection for the user because they are dependable in operation. The safest investment for the dealer, engineer or contractor because they give satisfaction.



The "Diamond H" on a switch is valuable insurance—assurance that quality, materials and competent workmanship are embodied to perfect production.



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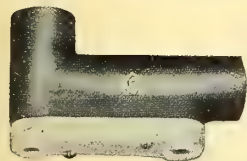
Canadian Sales Agent:

C. W. Bongard, Toronto, Canada

CONDUIT FITTINGS



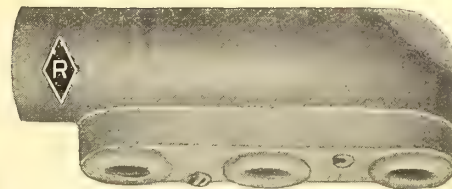
F 1/2"-2 Wire Cover



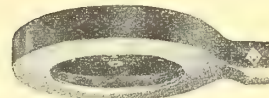
LB 1/2"-2 Wire Cover



A 1/2"-3 Wire Cover



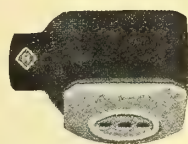
E 1/2"-3 Wire Cover



P 1/2"



445-Reversible Guard



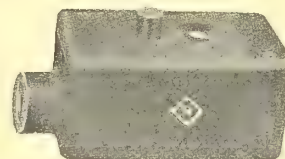
K 1/2" Plug



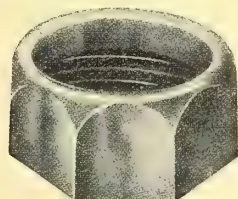
J 1/2" Receptacle



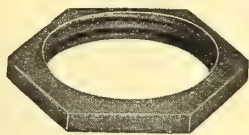
3/8" Fixture Stud



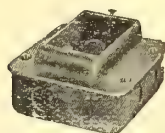
FD 1/2" Push Switch



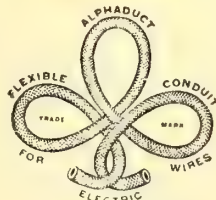
1/2" Bushing



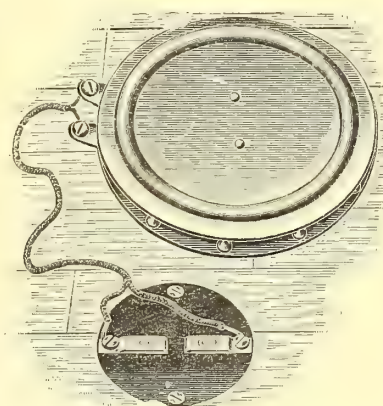
3/8" Locknut



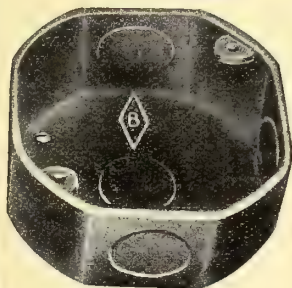
1915-Switch Box



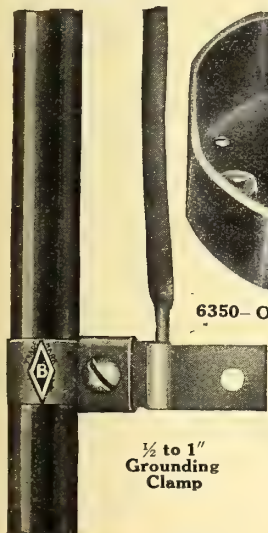
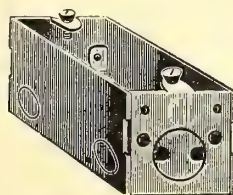
Alphaduct 1/4"



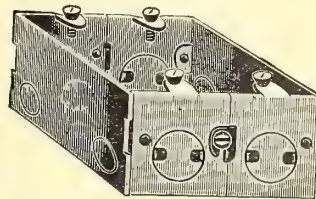
150-Floor Tread



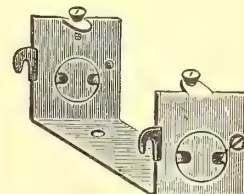
6350-Outlet or Junction Box

1/2 to 1"
Grounding
Clamp

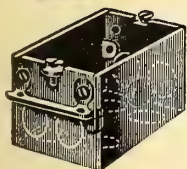
170-Comb Switch Box



172-2 Gang



171-Spacer



CCS. I. Switch Box

Electrical Fittings Co. Limited

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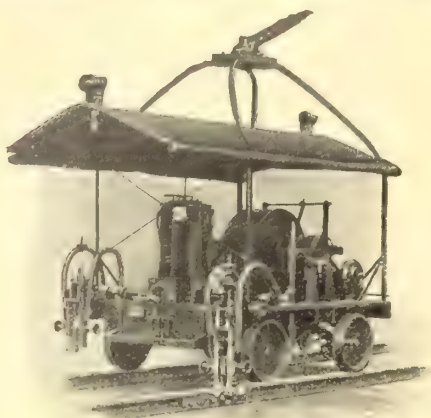
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When once installed, they are on to stay and cannot be removed without actual mutilation and considerable hard work.

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American Sewer Pipe Co., AKRON, OHIO. Vitrified Conduit—Best Made

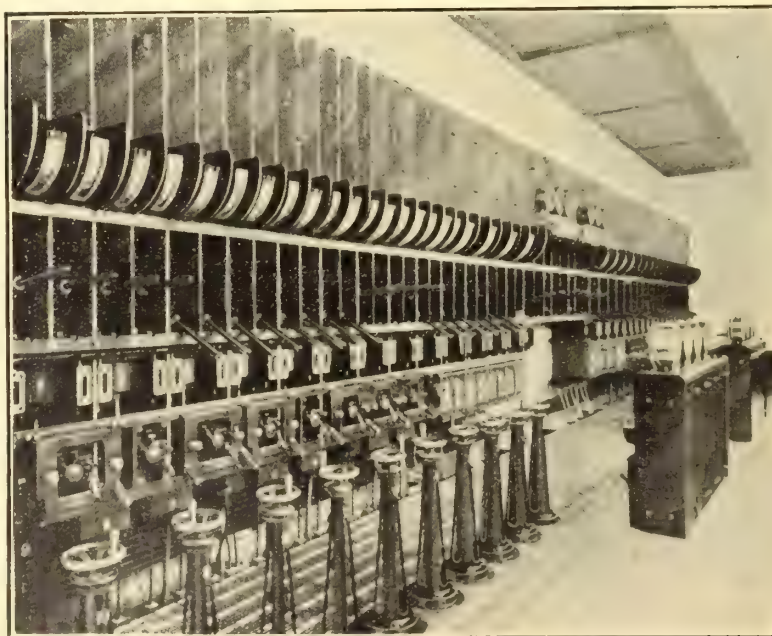


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combined with
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and
High Class
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We find that the fewer insulators tested at one time the higher the **apparent** voltage necessary to "flashover" which gives a spectacular but small dynamic effect, whereas a larger number of insulators tested at one time requires an equally high voltage to flashover, but on account of the large capacity involved gives surges and actual dynamic effects that DO DAMAGE and approximate line abnormal conditions.

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"Stave Arcoflame"

The Longest Life from the
Shortest Flaming Arc Lamp
100 Hours per Trim

The Lamp for
Street Lighting, Factory Lighting, Railway Terminal Lighting.

The Latest "EXCELLO"

Extra Shallow P.B. Switch
Electrically and Mechanically Perfect.
"Every Excellor Switch has an Action All Its Own."

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Importers of
"Sterling" Drawn Wire Tungsten Lamps, "Sterling" Carbon Lamps

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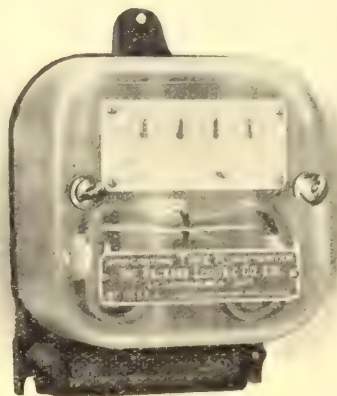
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Perfect Workmanship



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Complete stocks also at St. Catharines and
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Write for New Full Descriptive Bulletin No. 120

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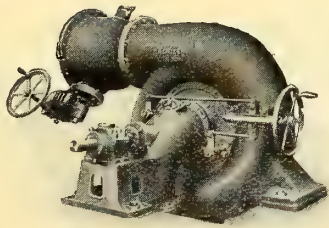
Factory: ST. CATHARINES

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WOOD, particularly porous woods such as poplar, basswood and maple, can be so impregnated with the famous product **BAKELITE** as to be rendered hard and resistant to chemical and physical influence.

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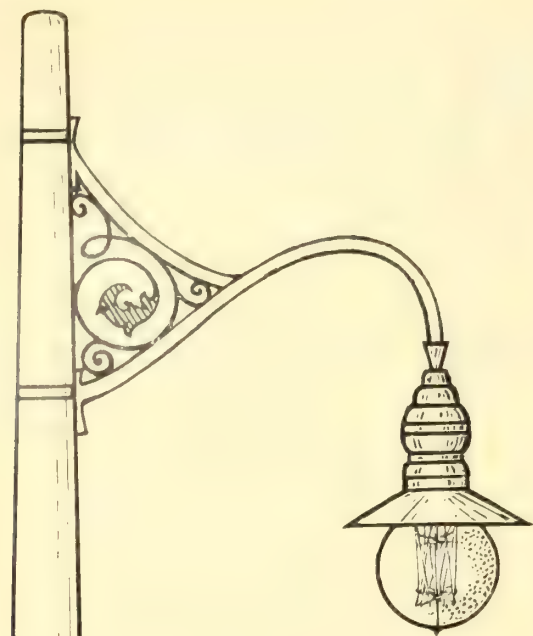


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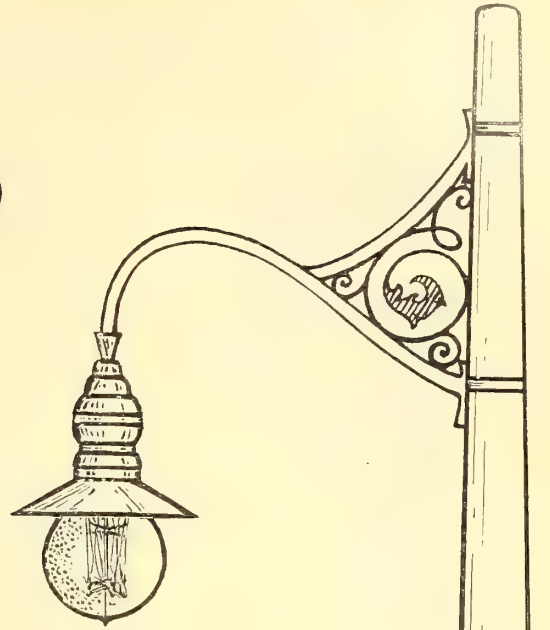
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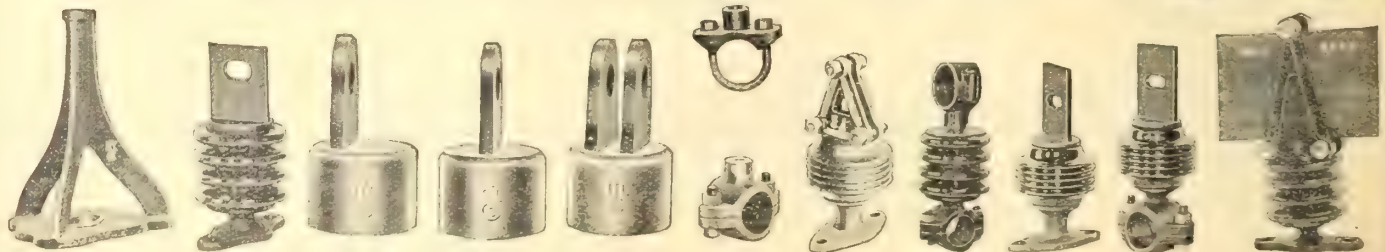
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Vol. 21

Toronto, May, 1912

No. 5

Canada's Canal Problems

The Board of Trade of the city of Toronto has issued a booklet discussing the relative merits of three canal plans, namely, (1) To enlarge, deepen and shorten the Welland Canal; (2) In addition to (1), to improve the St. Lawrence canal system; (3) To construct a 22-foot ship canal from Georgian Bay to Montreal via the Ottawa River.

The report opposes the claims made for the Georgian Bay canal and supports the Welland and St. Lawrence scheme. It states that the possible speed claimed for the Georgian Bay route is impracticable, that the capacity suggested would not meet future requirements, that the time and cost of construction would greatly exceed the estimates, that the locks proposed are too small, and that the power development of 1,000,000 h.p. would not carry any great value on account of a lack of market.

On the other hand it is stated in support of the Welland-St. Lawrence scheme that it is practicable, that its cost would be reasonable, that it could be finished in a comparatively short time, that its capacity would be greater, that it has along its line a large number of manufacturing towns, that it would off-set the effect of the new Erie Canal now being built by the United States and so prevent Canadian traffic from following that course, and finally that the water development of some four to five million h.p. would pay easily for the cost of the project in that it would much more likely find an immediate market in the large towns and cities along the St. Lawrence river.

It must not be forgotten when discussing a possible

water power development, however, that it cannot be hoped in the immediate future to find a market for even 1,000,000 h.p. in any one neighborhood in Canada. All the Niagara companies put together are probably not developing more than 300,000 to 400,000 h.p. That a larger amount of power will be ultimately required there can be little doubt, but more than anything else the date of this requirement will depend on developments in long distance transmission. With this problem solved it would appear that the power along the Georgian Bay route is more centrally located with regard to the probable industrial developments in Canada. It is also worth remembering that the developments on the St. Lawrence would be at a point not so very far removed from other large developments close to the cities of Montreal and Ottawa, so that the area of this market field, does not look to be as large as it would be for the water powers to be developed along the Georgian Bay route.

The New Power Commission Act

As finally passed the act to amend the Power Commission Act is somewhat different from the original draft of the bill. A clause is now inserted providing for a salary for the chairman of the Hydro-electric Commission and for possible payments to the other members. Full powers are given the Commission to expropriate whatever lands are necessary for water power development. Power is given to expropriate any plant or any part of any plant used for electrical distribution, but a clause is here added to the effect that "If part only of the property is taken the damage done to the property by the severance shall be taken into consideration in determining the compensation."

An important amendment gives the Commission power to make regulations as to the construction, operation and inspection of any electrical plant of any kind whatever, including street railways, with power to appoint the inspectors. They may also at any time order changes in a plant which they may consider necessary for the safety of the public. There is no doubt that power of this sort judiciously exercised by the Commission will have an entirely helpful effect on electrical operations. Throughout the Dominion there are to-day a number, perhaps small, of electrical distribution systems which are indeed a menace to public safety. An occasional poor transmission line or distribution system is built by either inexperienced or careless workmen quite without the knowledge of the municipality or the company who are paying for the work. This is not so likely to be true of the larger private companies who are very watchful of their interests and also well able to provide the best available advice and inspection in all such matters. If the Commission will conscientiously take up the inspection of some of the improperly installed smaller plants, as well as keep an eye on some of those that are being put in at the present time, results will undoubtedly be accomplished which will meet the approval of well-informed electrical men.

The question of rates has also been placed entirely in the hands of the Commission. There has been dispute in connection with this matter, the municipalities claiming that they should have the right to set their own rates. It has been, in certain cases, and is yet the case, that rates have been placed below actual cost, and systems are run at a loss financially. This can only mean ultimate dissatisfaction among the customers of the system. If the Commission will fix the rates in every locality so that bare expenses at least will be made, the ultimate result of municipal enterprises will be more secure. Along this line power is also given the Commissioners to outline a system

of bookkeeping which each municipality and corporation will be expected to follow.

The vexed question of what to do with the surplus is being decided with apparent fairness, though it would almost appear that a municipality should have the right to do as it liked with its own. However, the Commission takes complete charge of the surplus for various reasons, but the act requires that this surplus must be used on the electrical system of the particular municipality to which it belongs. The four regulations which have been added on the amended bill make this disposition clear for the surplus must be applied in one of the four ways:—(a) In the reduction of any indebtedness incurred; (b) In the maintenance, repair or renewal thereof; (c) In extensions; (d) In the formation of a reserve fund.

With respect to the placing of wires underground the Commission is given the power to require this work done if it is deemed necessary or expedient for the protection of life or property or for the convenience of the public. Another clause gives the municipality power to construct underground conduits at its own expense in which case all operating companies using wires would be required to make use of this conduit at a compensation to be determined either by private arrangement or by reference to the Commission.

Theory of High Voltage Phenomena

It is satisfactory to note the increasing interest taken by our universities in problems dealing with the practical and industrial side of our education. It has been argued, and perhaps justly, that the average university fits its graduates for theorizing rather than practice, for deliberation rather than action, and that the problems of an industrial age do not reach their solution by the application of such principles. In electrical problems, as undoubtedly in other lines, this lack of co-operation has been due to a two-fold cause—traditions as to the aim of education, and the lack of funds. Of these, the first is being rapidly outlived, while of the second it can at least be said that financial circumstances are not as straitened as they were a few years ago. The argument that would seem to bear most weight with our universities on the question of putting research scholars to work on industrial problems is that, in competition with numerous wealthy manufacturing corporations who unhesitatingly provide themselves with the best, both of apparatus and men, that money can buy, the universities cannot hope to keep pace. That there are counter arguments is shown by the fact that many of the best educational institutions in Canada and the United States are setting their best men to work on industrial researches of almost every kind. As examples, Harvard University is planning to build a magnificently equipped high tension electrical laboratory, the University of Toronto is now equipping a 200,000 volt testing and experimental laboratory, and McGill University is already well equipped along a similar line.

As evidence of the good work that can be accomplished in these laboratories the result of recent experiments on the all-important question of high tension insulation, as carried out in McGill University lately was recently outlined in a valuable paper by Messrs. A. M. Gray and A. McNaughton presented before the electrical section of the Canadian Society of Civil Engineers. The paper deals with such problems as the variation of the dielectric strength of insulators with thickness, the relation between corona discharges and ionization, temperature and pressure effect upon corona, corona discharges from wires of different sizes, etc. The effect of air pockets in insulators and the necessity and best methods of eliminating these in the construction of electrical apparatus is discussed at length. The various factors regulat-

ing the proper design of insulators for different purposes has been investigated and considerable space is given to the study of a transformer, considering it as a condenser, and the effect on the voltage of the low-tension side under different conditions of varying conditions on the high-tension side.

The paper appeals to one as having combined the theory and practice of a number of important problems in a very satisfactory manner. We print copious extracts from it, with some illustrations, on another page of this issue.

Sharp Rise in Copper

In view of the sudden rise in the copper market during the past few weeks the following data referring to the market values of the past year are interesting. It would appear that the copper market has been almost unduly depressed owing to the advent of aluminium in competition. However, the use of this latter metal has not become so general as was anticipated in some quarters and it is found that the fields of the two metals lie somewhat apart. Even at the point where they overlap most, in high tension transmission, copper during the last few months seems to be more than holding its own.

For the manufacture of electrical conductors, electrolytic copper is chiefly used, although in some cases what is known as "Lake Copper" (which is naturally pure) is used. The average New York monthly prices of electrolytic copper during the year 1911 are given below. Also the average New York monthly prices of casting copper:

Average New York Monthly Prices for Year 1911

	Electrolytic Copper	Casting Copper
January	12.53	12.39
February	12.48	12.33
March	12.31	12.20
April	12.15	12.07
May	12.13	12.08
June	12.55	12.40
July	12.62	12.49
August	12.57	12.42
September	12.39	12.23
October	12.36	12.21
November	12.77	12.61
December	13.71	13.56

The New York price of rods, the form in which it is chiefly obtained by the wire and cable manufacturing companies, runs from $\frac{3}{8}$ to $\frac{1}{2}$ cent above the price of electrolytic copper in New York. At the present time the price of electrolytic copper in New York is about 16 cents, and the market is strong. The price of copper wire is, of course, higher than the figures quoted here. The corresponding base price of solid wire in Canada at time of writing is 18 cents a pound.

It is of interest to note the average prices of the last few years on electrolytic copper. The New York average yearly prices were as follows:

1902	11.96
1903	13.62
1904	13.11
1905	15.98
1906	19.77
1907	20.86
1908	13.89
1909	13.11
1910	12.88
1911	12.55

The average New York price of electrolytic copper for March, 1907, was 25.74, the highest price reached during the last ten years.

Protest Raised by the Conservation Commission Against Chicago Diverting More Water from the Great Lakes

A strong protest was registered by the Commission of Conservation before the United States Secretary of War, at Washington, on March 27, against allowing the Sanitary District of Chicago to divert additional water from Lake Michigan. Hon. Clifford Sifton, Chairman, and James White, secretary, presented the case for the Commission. Chicago now has permission to divert 4,167 cubic feet per second from the Great Lakes system for sanitary purposes and wishes to increase this amount to 10,000 cubic feet per second. Such a diversion would seriously affect the levels of the Great Lakes and of the St. Lawrence canals. This would decrease the amount of power available at Niagara and on the St. Lawrence, and would affect adversely the shipping of the Great Lakes, which annually carries freight valued at over \$650,000,000. In view of these facts, and also because the increased diversion is unnecessary for sanitary purposes and is clearly in violation of the Boundary Waters Treaty of 1909, the Commission of Conservation placed itself on record as being strongly opposed to the granting of the application.

Effect on Lake Levels

Although Chicago has permission to divert only 4,167 cubic feet per second, she has taken it upon herself to use 10,000 cubic feet per second. When the waters of the Great Lakes are at an average level, diversions of 7,000, 10,000, and 14,000 cubic feet per second, would lower the waters of the various lakes (in inches) as shown in the following table:

Lowering of Lake Levels by Diversion at Chicago

	7000 c.f.s.	10000 c.f.s.	14000 c.f.s.
Huron-Michigan	4.25	6.25	8.5
Erie	3.87	5.5	7.75
Ontario	3	4.25	6
St. Lawrence	3.37	4.75	6.75

That is under average conditions. For low-water conditions, these reductions in level would be larger, thus increasing the injury to navigation. In 1911, for example, when lakes Huron and Michigan were at a lower level than usual, a diversion of 10,000 cubic feet per second would lower the level 7.25 inches. The average annual range of these lakes is 1.21 feet, and the proposed diversion would thus affect their levels to the extent of 50 per cent. of the annual range. The Commission of Conservation contended, therefore, that such a diversion was in contravention of Article VIII. of the Boundary Waters Treaty of 1909, which forbids the construction of works that "materially" affect the level of international boundary waters.

Lessen Power at Niagara

The Commission contended, that every cubic foot of water abstracted at Chicago, would reduce the amount of power that could be generated at Niagara Falls and in the rapids of the St. Lawrence River. This would work to injure the provinces of Ontario and Quebec, and the State of New York. The Chicago Drainage District contemplated using the water diverted from Lake Michigan for generating power near Chicago, but this would involve an economic waste, because of the lower head available there. The amount of water used to produce one horse-power at Lockport, Ill., would generate from 5 to 7 horse-power at Niagara.

For Power Development

As a matter of fact, the promoters of the Chicago Drainage Canal have not been backward in stating openly that they intended to develop and sell power from the Drainage Canal to reimburse themselves for expenditures made. Lyman E. Cooley, late Chief Engineer of the Sanitary District, and one of the principal promoters of the

project, declared it was his "hope and intention" to excavate a channel having a capacity of 16,667 cubic feet per second, and this he estimated "will produce 173,000 horse-power, and, with the revenue therefrom, the State of Illinois proposes eventually to recoup itself for its expenditures and contribution to the deep water-way." From this it would seem that the present application was only the beginning of the demands for permission to divert more and more water.

The Commission of Conservation argued that this diversion, for the purposes of water power development, of waters, belonging essentially to international boundary waters, could not, on the ground of international law, be justly sanctioned.

Concluding, the protest says: "The Executive of the Commission of Conservation expresses the opinion that the application is without even the semblance of necessity, and desires to place on record its unqualified opposition to the proposition which is before you."

Toronto Section A. I. E. E.

What was probably the last meeting for the year of the Toronto Section of the A. I. E. E. was held on April 12th at the usual meeting place, the Engineers' Club, King street, Toronto. The paper was presented by Mr. Wills MacLachlan, Belleville manager of the Electric Power Company, on the subject "The Electrical Equipment of the Dominion Government's Grain Elevator at Port Colborne."

The paper explained that this elevator was not of large capacity, being designed to hold grain for only such time as it could be trans-shipped from vessels of lake capacity of 22-foot draft to vessels of Welland Canal capacity of 14-foot draft. In point of fact the equipment was specially designed for the rapid handling of comparatively small amounts of grain with the result that this elevator has at different periods held time-records in the matter of loading and unloading lake vessels. As an example the fact was mentioned that the steamer Key West was loaded with 84,000 bushels of wheat in an hour and eighteen minutes, this loading being from empty hoppers above the scales to a trimmed boat.

The Parts of an Elevator

The speaker stated that an elevator naturally divides itself into three parts, one part for receiving the grain, one for handling it in the elevator, one for shipping it out of the elevator. The part for receiving the grain is called the Marine Leg, and the form used in Port Colborne is called the grasshopper type. This consists of an endless bucket scheme that dips into the hold of the boat, bringing the grain to the elbow of the Leg, whence it is carried by a chute to the foot of the elevator proper. At this point, where the grain is received in the bottom of the elevator, there is a small storage bin called the boot. The grain is brought to the mouth of the leg which dips into the hold by reversible grain shovels which travel from end to end of the car and dump each way at the centre.

When the grain is once received in the boot of the elevator it is carried up by an endless bucket scheme called a Lifter to the elevator. The lifter dumps the grain into a hopper from which it falls on the scales, thence to a lower hopper and thence by distributing spouts to bins.

The third function of the elevator consists in reloading the grain. It is again delivered to the boot, carried as before to the hopper, passed through the scales to the second hopper and, instead of returning to the bins, delivered by a horizontal carrying belt through the gallery to the loading spout which leads it to the canal-size boat.

An interesting item in connection with the weighing of the grain stated that the scales are of one hundred bushel

capacity and that they fill, weigh, dump and register one hundred bushels of grain automatically in from twenty-eight to thirty-two seconds.

The paper goes on to state that the Port Colborne elevator is admirably situated for electrification, being only twenty-five miles from Niagara Falls. Power is obtained from the Ontario Power Company by a 12,000 volt, 25-cycle line and transformed through 300 kw. oil-insulated self-cooled units down to 550 volts. The transformer house is a separate building and the paper very minutely describes the arrangement of the wiring and the apparatus.

All the movable machinery in this elevator is operated by electric motors, of which there are twenty-six in number. There is also one small generator for operating certain solenoids requiring direct current. Twenty-four of the motors are controlled from the motor switchboard. The other two motors are, an elevator $7\frac{1}{2}$ h.p. slip-ring induction motor and a two h.p. motor driving a one kw. d.c. generator.

The main motors of the elevator are squirrel cage induction motors, three-phase, and are divided as to their uses as follows:—lofter motors, marine leg motors, winch motors, fan motors, line shaft motor, car haul motor. The lofter motors are nine in number with 125 h.p. capacity each. The marine leg motors are four in number with 100 h.p. capacity each. A 50 h.p. motor drives the line shaft which operates a number of belts. This motor is connected to the shaft by a short rope drive. A 30 h.p. motor drives the car hauling machinery. Five 15 h.p. motors operate the fans, two of which are located on the ground floor and three on the top floor. The latter three drive two fans each.

Method of Starting Motors

The paper explains in some detail the method of starting and running the motors. The general scheme is called "central control." The current comes from the low tension side of the large transformers through lead covered cable into the main building. Here it is passed through the main disconnecting switchboard where the high tension taps for the lighting transformers are taken off. It then passes to the switch rack in which there are two sets of bus-bars, one live at 550 volts, the other normally dead. Connection is made between the live bus-bars to a ten point auto-starter and from here to the dead or starting bus-bars. Each motor is connected to the centre by a double throw three-pole oil-switch, one side of which is connected to the running bus-bars and the other to the starting bus-bars. In starting up a motor the practice is to throw the live switch so that connection is made from the starting bus-bars to the motor leads. The voltage is then raised on the starting bus-bars by cutting in higher points on the auto-starter, at the same time watching the ammeter. When the highest point on the auto is reached the motor switch is thrown over so that connection is made from the running bus-bars to the motor leads, the auto-switch being cut out at the same time. The motor will then be running up to speed. To stop the motor it is only necessary to bring the motor switch to its central or off position.

A special arrangement has been made for drying out motors which may have become wet from rain or water coming in over the dock wall. The high tension taps for the lighting transformers are taken off the main leads from the main transformer room and so connected that it is possible to obtain 550 volt, 3-phase, a.c., on the motor bus-bars, or by a special tap arrangement on the transformer 220-volt, 3-phase, a.c. on the same bus-bars. It is the latter voltage which is used for drying out.

The handling of the grain is controlled by a set of electric signals consisting of lamps and bells. There are six stations that require to be notified when the grain is to be moved, the unloading wharf, work floor, distributing

floor, motor gallery, scale floor and loading wharf. To accomplish this there are three distinct sets of signals as follows, the cupola and work floor to unloading wharf for the unloading of grain, cupola to loading wharf for the loading of grain, and cupola to work floor for the unloading of grain in elevators.

Steam Equipment for Hydro-Electric City

The Ottawa, Light, Heat & Power Company have just awarded contracts for Babcock & Wilcox boilers and a Westinghouse Parsons turbo-generator of a capacity of 6,000 h.p. In view of the fact that Ottawa is advertised as having more power than Niagara this will come as a surprise to many electrical men. The matter has been considered, however, from every point of view by the Ottawa company, who have come to the conclusion that under existing conditions they are justified in making this addition to their steam generating apparatus.

Mr. A. A. Dion, general superintendent and electrical engineer of the company, states that this equipment is being installed not so much to carry the regular load of the company as to care for the peak load business and also, incidentally, to act as an auxiliary in time of trouble at the water plant. Mr. Dion is of the opinion that while hydro-electric power may be produced cheaper than steam electric power where the load is comparatively continuous, this is not the case where the equipment is to be used for only two or three hours a day, and perhaps only for one season of the year. No doubt, too, the unsatisfactory condition of the Ottawa river at certain periods of the year has had something to do with the settlement of this question. At the Chaudiere Falls there are a number of different companies operating, and it is difficult to determine just what amount of water each is taking at any time or what amount each company is entitled to. After the completion of the reservation dams which the government is constructing at different points on the Ottawa river, these conditions will no doubt be in part remedied. The main point of interest, however, is that in a city where the conditions are about the most satisfactory for the production of cheap hydro-electric power of any city in Canada, a thoroughly progressive company should have reached the conclusion that a combination of steam and water power in almost equal proportions forms the most economical basis of operation.

Toronto Rejuvenation

Geo. C. Rough, Statesman for Ontario, with an able degree team, held a rejuvenation of the Sons of Jove in Toronto on March 29th, at which seventeen members of the electrical fraternity were admitted to the order, which now has a membership of approximately six thousand. It was a lively session, and would have been more so but for the non-arrival of some of the paraphernalia from Winnipeg. Mr. Rough was toastmaster at the banquet, which afforded an opportunity for several of the members to discourse on the benefits of jovianism.

70,000 Kw. in Tasmania

Mr. J. W. Fraser has tendered his resignation as assistant chief engineer of the Southern Power Company, Charlotte, N. C., to assume charge of the erection, for the British Westinghouse Electric & Manufacturing Company in Tasmania, Australia, of a 70,000 kw. hydro-electric plant to be operated by the Hydro-electric Power & Metallurgical Company. Mr. Fraser, who comes from Nova Scotia, and who received his engineering training in McGill University, Montreal, taking the B.Sc. and M.Sc. degrees in 1899 and 1901 respectively, was connected with the Westinghouse Electric

& Manufacturing Company, East Pittsburg, Pa., and the Shawinigan Water & Power Company prior to becoming associated with the Southern Power Company in 1906. Since that time his experience has covered the design and construction of transmission lines for e.m.f.'s of from 2200 to 100,000 volts, more than 300 miles of the system of the Southern Power Company being operated at the latter voltage. Mr. Fraser sailed on April 15 for Manchester, England, from which place he will later proceed to Tasmania.

A 25,000 Kw. Parsons Turbine

An announcement has just been made that the Commonwealth Edison Company, of Chicago, has placed an order with the C. A. Parsons Co. for a 25,000 kw. horizontal steam turbo-generator to be installed in their Fisk street station. This is an innovation on the part of the Commonwealth Edison Company, as all the units previously installed have been of the vertical type. The new turbine will be built under the direct supervision of the Hon. Chas. A. Parsons, who is probably considered the leading authority on steam turbine work the world over. The new unit, which is one of four to be ultimately installed, will be 75 feet long and 18 feet wide. The auxiliary machinery will be placed in the basement under the turbine room. The generator will be wound for 4,500 volts, 25 cycles and operate at 750 r.p.m.

This announcement recalls a statement made by the president of the Commonwealth Edison Company, Mr. Samuel Insull, at the last convention of the Canadian Electrical Association, when he stated that his was the largest steam electric power production plant in America operated by one company. Mr. Insull also had a word of encouragement for the various steam plants throughout the country who were fearing that the introduction of hydro-electric power into competition would likely result in a reduction in rates to a point where they could not compete. He pointed out that the distribution system, which represents a majority percentage of the total outlay, would unquestionably be the same in each case and, taking Buffalo as an example, Mr. Insull stated that he believed a steam generating plant located there could compete with electric energy brought from one of the hydro-electric plants at Niagara Falls. This is especially encouraging to steam plant operators, as Buffalo is, comparatively speaking, unusually well situated in the Niagara power zone. That Canadian operators hold similar views is shown by the present steam extensions in Ottawa and the large steam equipment of many of our largest hydro-electric companies such as the B. C. E. R. Co. and the Winnipeg Electric Company.

140,000 Volt Transmission Line

A current issue of the *Electrical World* publishes a description of the highest voltage transmission system in the world, that of the Aux Sable Electric Company's new 23½ mile system connecting its water power sites on the Aux Sable river with Bay City, Saginaw, Flint, and which will be extended to Lansing and Battle Creek. One hundred and twenty-five miles of this line has been in successful and uneventful operation for over a month at 140,000 volts. The conductors are supported on suspension insulators composed of ten 10-in. discs, each disc tested to stand 80,000 volts continually. The line is carried on steel galvanized towers of the tripod construction spaced about 500 feet apart. Two conductors are carried on one side each 12 feet apart vertically, the other two sides of the triangle being 17 ft. 4 in. The conductors themselves are No. 1 equivalent, medium hard drawn standard copper and are said to seldom show coronal discharge. As far as has been shown the difficulties of operation of the 140,000 volt system are not greater than those met at 110,000 volts or lower.

Electricity vs. Gas for Lighting

Another fatal Toronto accident due to suffocation by illuminating gas brings up again the question of the advantages of electricity over gas for illuminating purposes, especially in residences, boarding houses, hotels, etc., where transients are accommodated and where people are apt to meet conditions to which they are not habitually accustomed. Time and again it has been advised that gas lighting was not suitable under these conditions and that electric lighting should be installed. The expense should no longer be a matter for consideration as there are few localities where electric lighting is not practically as cheap as gas and the installation probably costs less. That the electric method of illumination is many times safer there is no room for doubt. Modern methods of installation with modern standards of equipment place the possibility of an accident from an electrical installation in a very remote quarter. It is quite true that the uninformed press from day to day report that this or that fire or accident was caused through defective electric wiring, but it is probably well within the mark to contend that less than five per cent. of the charges made against electricity causing accidents are true. With modern installations electric accidents in houses are an unknown quantity. With these facts in mind it is difficult to understand what excuse there is for allowing such institutions as hotels or boarding houses to be equipped with any but electrical appliances.

Suspension Insulators on Wooden Poles



The Lindsley Bros., of Spokane, Wash., dealers in cedar poles, have just issued a little pamphlet entitled *Western Cedar Poles versus Steel Towers*, containing a description of a 50,000 volt transmission line in Montana. The line is 86 miles long, and is built entirely of 45-foot western cedar poles. It consists of three strands of three copper wires each, one steel ground wire equal in weight to one of the copper strands, and two telephone wires. This line was completed in 1910 and has an efficiency record of one hundred per cent. to date. The standard spans are 300 feet long, but one span crossing the Yellowstone River is 834 feet long. Suspension type insulators are used throughout. The accompanying sketch shows a typical pole construction.

All these poles are treated with Averanius Carbolineum by the open tank process and, it is claimed, will last from two to three times as long as the untreated pole, the life of which is estimated at from twelve to fifteen years.

The booklet also argues that steel towers cost from two to five times as much as Treated Western Cedar Poles, and require constant attention in the way of painting, etc., to make them last their ordinary lifetime. They attract lightning, and the current is easily grounded through them. They occupy much more space than the wooden poles, and offer greater attractions in the way of climbing to the small boy and other trespassers.

Remember the Canadian Electrical Association convention in Ottawa, June 19, 20 and 21.

Modern Methods Illustrated in Conduit Work at Transcontinental Shops, Transcona, Man.

An installation which illustrates the modern method of conduit construction for large railway shops, was made during the past year for the Grand Trunk Pacific Railway Company in their shops at Transcona, Manitoba. The system as laid out provides for the electric feeds to the various drills, lathes, pressers, slotters, compressors and other machines, and in the main consists of two manholes connecting with sixty-eight service boxes by means of either single, two-way, three-way or six-way vitrified clay conduit. From the various service boxes loricated conduit lead to the different machines, also to the switches which are located on the columns of the building.

The main run of six ducts in the locomotive shop connects the two 6 x 6 x 6 ft. concrete manholes at either end



Fig. 1

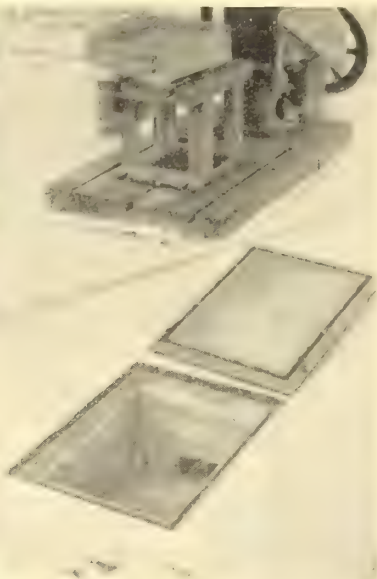


Fig. 2

of the building. In between these several service boxes, 24 x 18 x 18 in., are placed at locations suitable for feeding the different machines. In some cases the top tier only of ducts was cut away at these boxes; in others the entire six ducts were opened into the box. In this building the heating is obtained through large concrete tunnels which cross the bottom of the building, and in order to take the conduit across these openings it was necessary to first construct a reinforced concrete cradle for them to rest in. Photograph, Fig. 1, shows where one of these heating chambers was cut to allow the conduits to cross. It also shows the service box before the cover was placed. After this duct was installed and all service boxes built, except the placing of the covers, the floors of the shops were laid and the covers placed flush with it. These covers with corrugated lid weigh about one hundred and eighty pounds each. Each is flanged and sealed with a gasket, thereby making them water-tight. Four machine screws hold the lid securely in place.

From the locomotive shop six-way ducts lead to the boiler shop where also are placed a series of service boxes for the various machines in this building. One, three and six-way ducts are used in this outlay. From the locomotive shop a two-way run leads to the frog and track shop, in which a series of service boxes are also installed, one of these, adjacent to a machine, is shown in Fig. 2. An idea of the level appearance of the floor when completed may also be had from this figure.

In general, the conduit is laid in a three-inch concrete

encasement, dowell pins maintaining the proper alignment. Each joint is wrapped with a burlap strip dipped in cement. With the concrete manholes and service boxes and with the vitrified clay conduit, durability, strength and fire protection were thereby obtained. The work was installed by G. M. Gest, of Montreal, who specializes in this class of work, and who has installed many thousands of feet of conduit in Montreal, Toronto, Ottawa and Winnipeg.

11,000 Volt Steel Tower Transmission Crossing Over the Saguenay River

La Compagnie des Eaux et de l'Electricite de Chicoutimi having their plant located on the right-hand bank of the Saguenay River, desired recently to furnish power for the village of Ste. Anne on the opposite bank. In the winter of 1910 and 1911 a temporary line was installed on wooden poles which were set in the ice. To make a permanent installation it was decided to install steel towers on the banks of the river to carry conductors for one three-phase circuit and one telephone circuit. The transmission circuit was designed for operation at 11,000 volts.

The nature of the ground was such that on the left bank of the river a low tower could be used. The bank at this point rises abruptly from the water's edge to a height of about 210 feet. On the right-hand bank, however, the slope of the land is not so steep but a suitable tower location was found at a point about 300 feet from the water's edge and at a height of about 45 feet above the high water mark. This makes the span between the towers approximately 2,300 feet, the tower on the right bank being 50 feet from ground to telephone conductor supports and 54 feet



30' and 50' Towers at Saguenay River

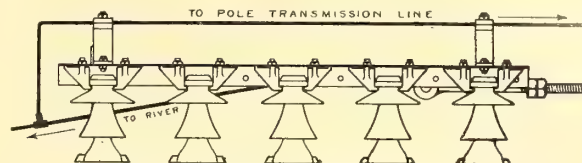
from ground to transmission wire supports. The transmission wires are 7/16 in. plow steel, having an ultimate strength of approximately 22,000 pounds. The telephone conductors are 3/8 in. plow steel, having an ultimate strength of 17,000 pounds. The cables were strung to a tension corresponding to a sag of 40 feet between level supports, giving a normal tension of about 6,800 pounds for the 7/16 in. size. This brought the low point of the wire at an elevation of 90 ft. above the high water mark, while over the channel the clearance is over 100 feet, as the channel is nearer the left bank of the river.

The towers were designed for a strain of 12,000 lbs. per

conductor and the cables were dead-ended on a group of insulators, as shown in one of the accompanying figures. This device consists of ten pin-type insulators, with a rated working voltage of 35,000, cemented on malleable iron pins. The insulators support a frame work on which a heavy clamp is arranged to slide, the clamp being controlled by a 1¼-in. bolt with adjusting nut. The strain is transferred to the insulators by castings which engage the groove in the insulator through a leaded jaw. The details are such that any insulator can be removed by taking out three ¾-in. bolts and a new insulator inserted without affecting the strain in the main cables. By the use of this device a very close adjustment of the sag can be obtained and an assurance that the strain is evenly divided among the insulators in a group. The telephone cables are carried in the same manner on six insulators of similar type. The towers are of a design sometimes known as the step ladder type, having braces in a plane at right angles to the line only. They are of unusually heavy section and are connected to the anchorages through 3-in. steel pins set in steel bolsters.

In installing the crossing, the wires were first carried across on the ice and anchored to temporary dead-ends set in the rock. After the towers were erected the wires were transferred to the clamps and drawn up to the proper sag. While this was being done, and before the last wire was drawn to its final position, an interesting test occurred. The

the cable until too late to avoid striking it. The boat was brought to a full stop by the strain on the cable and swung over on its side from the force of the current. It was held in this position until another tug came out to its rescue. After the cable was released and pulled up to its proper



Section of Insulator group carrying Cable

clearance it was shown that no damage had occurred to the towers or insulators from excessive strain.

The towers and insulator attachments were designed and built by the Archbold-Brady Company, of Syracuse, N. Y. The field work was done under the direction of Mr. J. C. Moquin, acting for the power company.

Personal

Mr. W. B. Shaw, manager of the Montreal Electric Company, St. James Street, Montreal, has returned from a three weeks' trip to the West Indies.

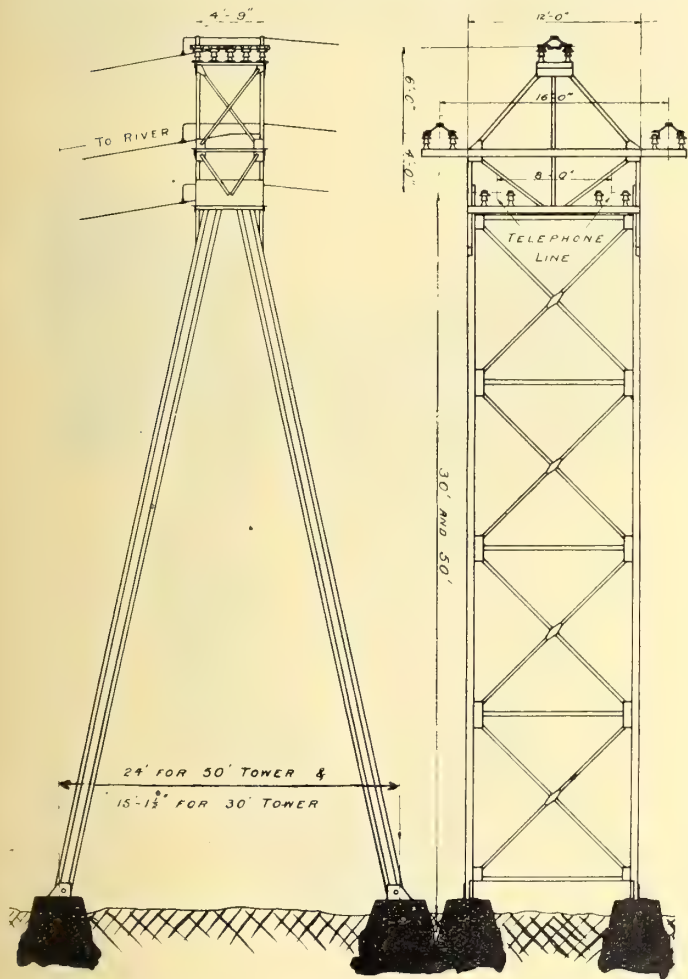
Mr. T. W. N. Hilliard, sales manager of the Canada Foundry Company, Toronto, has tendered his resignation and associated himself with the Canadian Crocker-Wheeler Company, St. Catharines.

Mr. J. H. Larmouth, general manager The Electric Power Company, has resigned that position to take up private manufacturing business. Mr. Larmouth's headquarters will probably be in Toronto.

Mr. Valentine Boyd, who has been connected with the Canadian General Electric Company of Toronto for some years, has joined the staff of the Canada Machinery Corporation, Galt, as assistant to the general manager. For some time Mr. Boyd has also been secretary of the Toronto branch of the American Institute of Electrical Engineers. The best wishes of the Electrical News go with him to his new position.

Mr. F. T. Thoms, who for the past few years has held an important position in the manufacturing end of the Westinghouse Company in the United States, has been appointed electrical superintendent of the Canadian Tungsten Lamp Company. Mr. Thoms' specialty has been specification lamps. Several new machines, pumps, etc., which had arrived a day or two before Mr. Thoms joined the company, are being set up under his personal supervision and these and the new re-organization will, it is claimed, add at least 75 per cent. to the daily output.

Mr. R. S. Kelsch, consulting engineer, Montreal, has been appointed by the Civic Utilities Committee of Kingston, Ont., to report on the relative merits of the two contracts submitted for the supplying of power to the city by the Hydro-electric Commission and the Electric Power Company. The prices quoted by the Hydro-electric Commission are,—\$36 for 1,500 h.p.; \$30.40 for 3,000 h.p.; \$26.64 for 4,000 h.p.; \$24.25 for 5,000 h.p. As opposed to this the offer of the private company is \$25 for anything up to 3,000 h.p.; \$23.50 for anything between 3,000 and 4,000 h.p., and \$21.50 between 4,000 and 5,000 h.p.



General Design and Dimensions of Saguenay Towers

cables had all been drawn up to their proper position except the last one, which hung about 20 feet from the surface of the water. One end of this cable was secured to the tower and the other end to an anchor in the rock. A tug-boat was coming down the river and the pilot did not see

Kindly notify us if you do not receive your copy of the Electrical News regularly

Brampton's Street Lighting System

A Model Town Installation—Detailed Description of Substation and Distribution Equipment—Power From Hydro Commission

On March 31, 1912, work was completed on the Hydro-Electric Distribution System for the Municipality of the Town of Brampton, one of the municipalities taking hydro-electric energy from the Ontario Power Commission. A brief description of this system is as follows:—

Current is supplied from Port Credit 110,000 volt sub-station to Brampton, a distance of some eleven miles, by a double circuit transmission line built on Idaho cedar poles, spaced approximately 120 feet apart. The pole line carries two circuits of No. 2 aluminium cable, one ground wire, and two No. 9 copper clad steel telephone wires for private use. The voltage of this line is 13,500 and so far has never had an interruption or given any trouble.

The sub-station at Brampton is composed of brick, steel and reinforced concrete, is fireproof in every respect and has the following equipment,—3-150 kv.a. Canadian Crocker-Wheeler 13,500 volts to 2,200 volts, oil-cooled transformers in the rear end of the ground floor, with provisions and room for the second bank. The front end of the same floor is used for meter testing, meter storage, lamp renewal, telephone apparatus, Commission and Bell telephones, and lavatories. The entire second storey is devoted to protective and switching apparatus, all furnished by the Canadian Westinghouse Co., of Hamilton. This is of the latest type and design and is made up as follows:—13,500 volt main switch and incoming panel, equipped with volt meters, ammeters, and graphic recording watt-

one for house and commercial street lighting, one for multiple street lighting. Electrolytic lightning arresters are on the 13,500 volt side of this apparatus and Westinghouse arresters of the latest type on the 2200 volt side.

The distribution system for the town is built on Idaho cedar poles of exceptionally fine quality, being very symmetrical in size, and very straight. These range from 40 feet in length to 60 feet. Under 40 feet native cedar poles have been used. All poles have been peeled and together with the cross-arms given two coats of battleship grey best quality lead paint. The cross-arms are standard dimension size, $3\frac{1}{4} \times 4\frac{1}{4}$, best Norway pine with standard spacing of 30-in. centres and 13-in. between wires. All hardware



The main streets have two lamps on every pole

is the best quality galvanized iron. All insulators are of standard brown porcelain type. The total number of poles placed approximately 120 feet apart is 700. Total kilowatt connected pole-type transformers 2200 to 110 volts for house lighting purposes is 175. The total connected pole-type transformers for multiple street lighting is 65 kw. The total connected pole-type transformers for power users 2200 to 550 volts is 350 kw. Total number of house and commercial connections, 500. Total number of 100 watt 110 volt tungsten lamps for multiple street lighting systems, 450. The height of these lamps from the curb is 10 ft. 6 in. and each lamp is encased in a ten inch Alba globe which diffuses the light and gives a very pleasing effect. In the main residential section these lamps are placed on every pole, or 120 feet apart; in the scattered or outlying districts on each alternate pole and on the very outskirts of the town one on every third pole. On the two principal streets, Main and Queen streets, there are two lamps to each pole directly opposite each other, one over the walk and one over the pavement.

The general system of wiring is as follows: Three phase feeder panels for house and commercial lighting; three phase feeder panel for street lighting; three phase feeder panel for power; the standard voltage for all these panels



One of Brampton's well lighted side streets

meter so arranged that it may be used on either the incoming lines or outgoing feeder panels, thus making it possible to check the incoming as well as any portion of the outgoing current.

In addition to this incoming panel there are three 2200 volt outgoing feeder panels, one for common power,

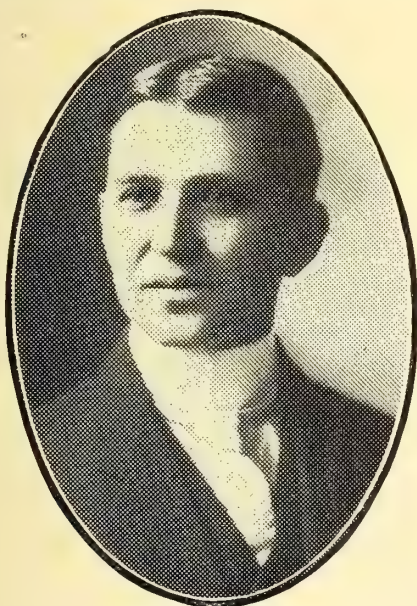
is 2200 to 110 with the exception of the latter which is 2200 to 550 which latter voltage has been standardized for all power users taking current from this municipality. All transformers used in the construction of this plant including the 13,500 kv.a. sub-station transformers are equipped with percentage taps, enabling the superintendent of this



Substation transforming 13,200 to 2,200 volts

plant to deliver power at any given voltage, irrespective of any drop either in the incoming lines or the outgoing system.

The Pearce bracket vertical type of construction has entered largely into all the secondary wiring in the residential district, especially in sections where trees are very



Mr. J. S. Beck

heavy. This has been found by actual experience to require much less trimming and cutting than formerly with the horizontal or cross-arm type of wire erection.

All primary leads to transformers have been taken down in the open on a special type of bracket designed by the superintendent, and the secondary connections from these transformers have been taken back up the pole in conduit, making a very clean-cut and workmanlike installation and one which will be immune from trouble.

The whole secondary system for both house and street lighting wiring has a common grounded neutral, making a five-wire distribution in congested or heavy sections and a three-wire distribution in residential or sparsely settled districts. This system of street lighting has proven out in this case to require less copper for given area of territory covered than the series system of street lighting and has been found to be far more flexible and easily handled. The fixtures for the street lighting system were designed by the Hydro-electric Power Commission and for design



Mr. H. E. Timmerman

and effect rank among the best in the Dominion which speaks well for this small municipality.

In addition to the distribution for the complete town the municipality has built a three mile extension from the town boundaries to the source of their water supply for the purpose of using electrical energy for pumping purposes. The construction of this line is as follows:—Native cedar poles from 30 ft. of 45 ft. in length. Two pin cross-arms, 30-in. centres and one Pearce galvanized bracket, making equilateral triangle formation, all hardware and fittings best quality galvanized. The conductors for this line are three wires of No. 6 bare hard-drawn copper. It is also the intention of the municipality to erect their own telephone line on these poles thus connecting their wells with the water works superintendent's house, also the house and offices of the superintendent of the Hydro-electric. This power line will also serve some ten or twelve rural or farm services between the corporation and the wells which will be one of the first steps in this section towards rural distribution.

The general engineering for the entire installation has been done by the Ontario Hydro-electric Power Commission and has been carried out by Engineer H. E. Timmerman who has been acting both for the commission and the municipality. He has been ably assisted and supported by Mr. J. S. Beck, member of the executive committee of the Ontario Municipal Union, chairman of the Hydro-electric Power Committee for Brampton, Reeve of the town, and Warden of the County of Peel.

Private Tenders Called for Cedar Rapids

Tenders have been invited by the Cedar Rapids Manufacturing and Power Company, Montreal, for the first section of their power scheme. This will comprise the construction of the dyke and part of the power house, at an estimated cost of about \$2,000,000.

Researches on High Tension Insulation

A Description of Recent Verification and Research Work carried on by the Electrical Engineering Department of McGill University

By Prof. A. M. Gray and Mr. A. McNaughton.

Definitions.—If a difference of electric potential be established between two electrodes a and b, Fig. 1, which are separated by an insulating material or dielectric, a molecular strain will be set up in the dielectric. This molecular strain is conveniently represented by lines of dielectric flux, and the number of lines of dielectric flux per unit area, which is called the **Dielectric Flux Density**, is taken as a measure of the strain. When the dielectric flux density reaches a certain critical value the material is disrupted and loses its insulating properties, this critical value depending on the nature, thickness and condition of the material. The distribution of dielectric flux depends largely on the shape of the electrodes, as shown by the two diagrams A and B, Fig. 2.

When an insulating material of uniform thickness t is tested at a voltage E between two parallel plates, the dielectric flux density, or molecular strain, is uniform through the total thickness of the material and is conveniently expressed by the ratio E/t , the volts per unit thickness. Under such conditions of test the maximum effective alternating voltage that one mil (0.001 in.) thickness

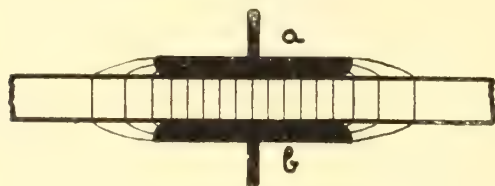


Fig. 1

of the material will stand for one minute is generally called its **Dielectric Strength**.

When the dielectric flux density is not uniform through the total thickness of the material then E/t , the volts per unit thickness, has little meaning. In Fig. 3, for example, which shows the flux distribution in the air between two parallel wires, it will be seen that the dielectric flux density, or molecular strain, is greatest near the surface of the electrodes and decreases as the lines spread out. Under such conditions the strain at any point is conveniently expressed by what is known as the **Potential Gradient** at the point, where this quantity is the volts per unit thickness that would be required to set up the same dielectric flux density as that at the point in question, if the material were of uniform thickness and tested between two parallel plates. The potential gradient curve is also plotted in Fig. 3.

Variation of dielectric strength with thickness.—The value of the dielectric strength expressed in volts per mil thickness, for two materials, micanite and presspan, much used in practice, is given in the following table:

Thickness of Test Sample	Dielectric Strength in Volts per Mil	
	(Micanite)	(Presspan)
10 mil	850	250
20 mil	800	190
40 mil	680	140

These figures show that the dielectric strength varies with the thickness of the test sample. This is principally a temperature effect and may be explained as follows: Consider two pieces of the same material, but of different thicknesses, subjected to a difference of potential propor-

tional to their thicknesses. The part of the material under strain becomes heated, and the amount of heat generated in each sample is proportional to its thickness, the areas of the electrodes being the same in each case. This heat is conducted to and radiated from the electrodes and the surface of the dielectric, but while the heat produced is proportional to the thickness of the material, the radiating surface remains practically constant, and so the temperature rise of the thick sample is greater than that of the thin one. Now the dielectric strength of a material depends on

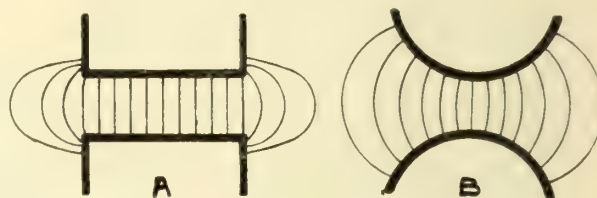


Fig. 2

its temperature, being lower the higher the temperature is, so that the thick material, which is the hotter of the two, will break down at a lower value of volts per mil.

Dielectric strength of air.—The cause of the disruption of air due to an electrostatic field is generally explained by the Ionic Theory, which is as follows:—In addition to the molecules of the gases which go to make it up, the air always contains a number of ions or infinitely small charged particles. When the air between two electrodes is subjected to a difference of electric potential the negatively charged ions are attracted to the positive electrode and the positively charged ions to the negative electrode and the ions have a certain acceleration, which is proportional to the strength of the field. If, now, the field is strong enough, and the distance between molecules large

enough, the ions acquire such a velocity that, when one strikes a molecule, the kinetic energy of this ion, which is then liberated, is able to break up the molecule into other ions. This action is cumulative and the air between the electrodes becomes filled with positively and negatively charged particles which carry electricity from one electrode to the other; in other words, the air becomes conducting.

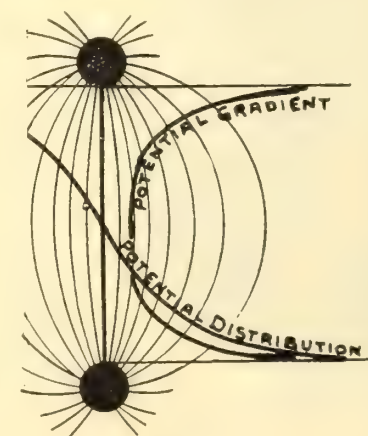


Fig. 3

As soon as the electrostatic field at any point becomes strong enough to cause ionization by collision, the air at that point begins to glow, due to vibrations set up by collisions between the ions and molecules. This glow is called the **Electric Corona**.

In the case shown in Fig. 3, where the air between two wires is stressed, the corona is first seen at the surface of the wires because, as shown by the curve in that figure,

the potential gradient or strain in the air, is a maximum at the surface of the wire and drops to such a value, at a short distance from the wires, that the ions no longer get the necessary acceleration to enable them to reach the velocity at which ionization by collision begins. The fact that ionization by collision and corona begin at the same instant, and that this instant also is that at which the discharge becomes audible, can be shown by the following experiment:—

A, Fig. 4 is a clean wire which is mounted concentrically in a brass cylinder B, and supported by means of two ebonite bushings C; a window of mica is placed at D through which the wire can be seen. Air is blown in at E and comes out at F, and in the passage F is mounted the terminal of a charged electroscope G. The potential between the wire and the cylinder, which is grounded, is gradually raised and it is noticed that at the instant the wire begins to glow the electroscope is discharged, due to the charged particles or ions in the air which is drawn over the surface of the wire. The original ionization in the air is so slight that it cannot be detected by the electroscope.

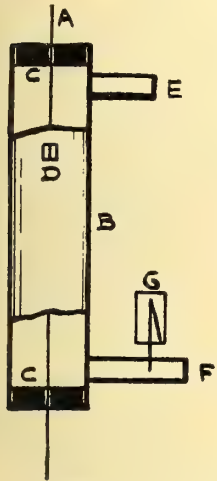


Fig. 4

on the acceleration and on the distance through which it moves before being stopped by a molecule. Now, an ion must attain a certain critical velocity before it can break up a molecule by collision and this velocity can be obtained by a rapid acceleration of the ion in a short distance or a slower acceleration over a longer distance. The higher the temperature and the lower the pressure of air the lower is its density and the farther apart are the molecules which go to make it up, and so, therefore, the lower the acceleration, or the weaker the electrostatic field necessary to start ionization by collision. Thus the dielectric strength of air is lowered by an increase in temperature and by a decrease in pressure; and compressed air is an excellent insulator.

Corona on Wires of Large and Small Diameter.—The following table gives approximately the value of volts per mil at which corona begins for different diameters of wire, and it will be seen that the dielectric strength of air is apparently higher when tested between wires of small diameter than it is when tested between those of larger diameter.

Diameter of wire in inches.....	.04	.08	.12	.16	.20
Volts per mil	136	113	103	96	93

This result may be explained as follows:—The curve in Fig. 3 shows the potential gradient at any point in the air between two charged wires. It is evident that the electrostatic field is not of uniform strength in the space between the wires, and is a maximum at their surface. Now, in order to attain the critical striking velocity in the distance between molecules it is necessary that the average acceleration of the ion be sufficiently large, but since the field is not of uniform strength a higher initial acceleration at the surface of the wire will be required than would be the case had the field been uniform. The smaller the diameter of the wire the steeper the potential gradient curve, and the higher the initial acceleration required for a given average acceleration, or the higher the value of volts per mil at the surface of the wire required to produce corona.

Insulators in Series.—If an air film be placed between

two electrodes and subjected to a difference of electric potential a certain dielectric flux density will be produced in the air. If now the air is replaced by mica six times the dielectric flux density will be produced for the same difference in electric potential. The specific inductive capacity of mica is six. The specific inductive capacity of any insulating material being defined as,—

$$\frac{\text{the dielectric flux density in the material}}{\text{the dielectric flux density in air}}$$
 for the same value

of volts per mil applied. Fig. 5 shows two dielectrics subjected to a difference of electric potential between electrodes of the same size and the same distance apart. In case A the

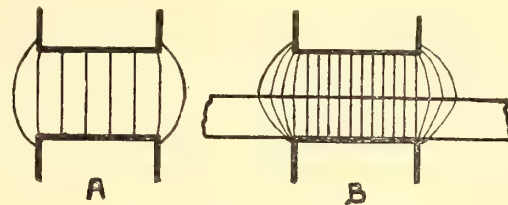


Fig. 5

dielectric is air, and in case B air and mica in series. Since the specific inductive capacity of mica is greater than that of air which it replaces, the dielectric flux density is greater in case B than in case A, for the same voltage between electrodes, and the air in case B is subjected to a greater strain than that in case A and so will break down at a lower value of terminal voltage, although at the same value of volts per mil thickness. Since the two materials in case B are in series, the dielectric flux density is the same in each, and, therefore,

$$\frac{\text{the volts per mil thickness in mica}}{\text{the volts per mil thickness in air}} = \frac{1}{6} = \frac{\text{sp. in. cap. of mica}}{\text{sp. in. cap. of air}}$$

It follows that the greater the thickness of mica in the total thickness between the electrodes, the larger will be the dielectric flux density and the higher therefore the value of the volts per mil thickness in the air for a given terminal voltage between electrodes.

Effect of Air Films in Insulation.—From the above it will be seen that, should there be an air film in the thickness of a solid dielectric, then for a conservative value of volts per mil of total thickness of the dielectric, (supposed perfect) the volts per mil across the air film may be sufficient to disrupt it if the solid dielectric have a higher specific

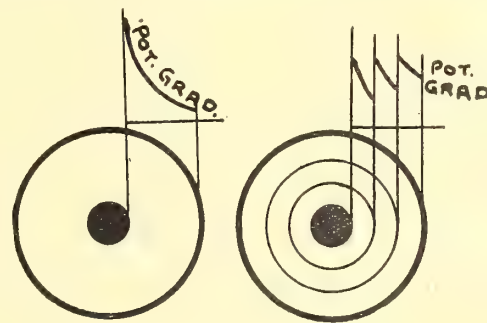


Fig. 6

Fig. 7

inductive capacity than one. When air is disrupted, ozone and oxides of nitrogen are formed, which oxidize nearly all the insulators used for electrical machinery, except mica, and thereby seriously impair their insulating properties.

The design of insulation for different purposes.—The voltage a given insulation will stand depends on:—(a) the thickness of the insulation; (b) the dielectric strength of the material; (c) the potential gradient across the material; (d) the length of time that the voltage is applied.

The thickness of the insulation.—Consider the slots of

a pair of alternators insulated in the one case for high voltage and in the other case for low voltage. If the space occupied by insulation could be filled with copper the output of the machine could be considerably increased, so that the solution of high voltage insulation problems cannot be solved economically by increasing the thickness of the dielectric indefinitely, with increasing voltage, but by the selection and power use of the most suitable materials.

The potential gradient.—Insulating materials break down wherever they are overstressed, and if the stress is not uniform they break down first at the point of highest stress. It is, therefore, necessary to make a study of the distribution of stress, or the potential gradient in the material. Consider the case of a high voltage cable. The lines of dielectric flux pass radially from the conductor in the centre to the lead sheath on the outside, so that the dielectric flux density is a maximum at the surface of the conductor and a minimum at the surface of the sheath, and the potential gradient curve, if the dielectric is of the same material throughout, is as shown in Fig. 6. The inner layers of the insulation, therefore,

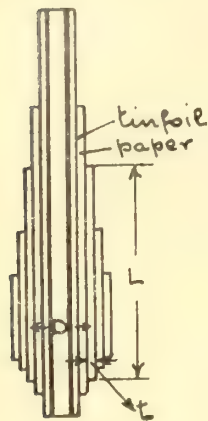


Fig. 8

carry more than their share of the voltage and these layers break down long before the stress in the outer layers has reached the break down point. It is possible to make the outer layers carry their share of the total voltage by grading the insulation in the following way: Materials having different specific inductive capacities are used and put on in layers in such a way that the lower the specific inductive capacity the farther away it is from the centre conductor. This relieves the strain on the inner layers because, as pointed out in the discussion of insulators in series, the voltage required to send a given dielectric flux through a layer of insulating material is inversely as the specific inductive capacity of the inner layers of the insulation, the lower the voltage drop across these layers, and the larger the voltage drop across the outer layers. The potential gradient of a graded cable is shown in Fig. 7.

In the case of high voltage transformer bushings, the potential gradient is sometimes adjusted by inserting layers of tin foil in the insulation of the bushing and maintaining them at a definite potential. The condenser bushing shown in Fig. 8 consists of five condensers in series between the

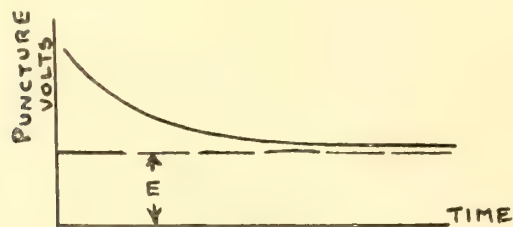


Fig. 9

centre wire and the outside surface. If the capacity of each of these condensers is the same, then the voltage drop across each condenser is the same, or each thickness of insulation between two layers of tin foil carries its proper share of the voltage. The capacity of a condenser $= C \times \frac{D \times L}{t}$, where C is a constant, and the meaning of the other symbols can be found in Fig. 8. The potential gradient can be controlled in many cases by a slight alteration in the shape of the surfaces to be insulated from one another.

Time of application of electric strain.—That the voltage

at which an insulating material will puncture depends on the length of time that this voltage is applied is shown by the curve in Fig. 9. It will be seen that there is a certain maximum voltage E which the material will stand for an indefinite length of time without deterioration due to heating and consequent puncture. If air films are present in the insulation then a lower voltage than E will cause puncture if applied for some time, but the action in this case is a secondary one. Under the heading of insulators in series it was pointed out that the stress on a thin air film bedded in a material of higher specific inductive capacity is very high, and that the film is consequently ruptured and ozone and oxides of nitrogen produced, which attack the other insulation causing deterioration and consequent puncture.

Breathing action.—The amount of these gases produced by the rupture of a thin air film is not enough to do much harm unless there is a constant supply of air to the film. When an electrical machine is started up its coils become heated, and since the gases in the film expand some of them are expelled. When the machine is shut down the coils cool off, the gases in the film contract, and a fresh supply of air is drawn in. This action is known as the "Breathing Action."

Trouble due to this breathing action of the coils takes months to develop and usually shows up in the form of breakdown between turns, the insulation between these turns, having become brittle due to oxidation, readily pulverizes due to vibration. The trouble can be eliminated by constructing the coils so that they contain no air pockets, and in the endeavor to do this various methods of impreg-

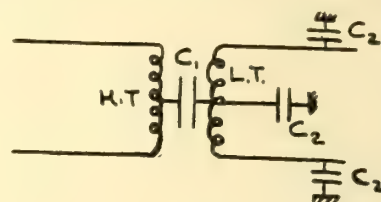


Fig. 10

nating the coils and sealing their ends have been adopted. The compounds generally used for impregnating purposes are made fluid by heating to a temperature of about 100 deg. C. and are used at that temperature. Most of these compounds contract about 10 per cent. in cooling to normal temperatures, and this 10 per cent., in most cases, becomes filled with air. It would, therefore, seem advisable to use as little compound as possible, especially between turns, and this can be done by the use of rectangular sections of copper wire rather than round ones; this will generally be done in any case for economy.

Since it may be considered impossible to eliminate all air pockets from a coil with present practice in insulating, it is advisable to allow the total thickness of the insulation to be so great that the average value of volts per mil, figured on the total thickness of the insulation, does not exceed 35 at normal voltage or, if it cannot be kept down to such a low value, to use mica between turns and also in the inner layers of the insulation since mica is not seriously affected by the gases produced due to the disruption of air.

Potential of the Low Tension Windings of Step Down Transformers.—Fig. 10 shows diagrammatically a step down transformer, which is equivalent to a system of condensers. One plate of the condenser is the high tension winding and its potential is taken as that of the neutral; the other plate is the low tension winding and its potential is taken as that of its neutral. In addition there is capacity between the low tension winding and ground, made up of the capacity of the low tension winding against the case, and of the capacity of the connected load against ground.

In a perfectly balanced high tension system the potential

of the neutral is zero, and under these conditions the potential of the low tension neutral is also zero. If the neutral of the high tension winding be displaced, the worst case of which is when one side of the high tension system is grounded, under which conditions the potential of the high tension neutral is 0.5 (line volts), the potential of the neutral of the secondary system is no longer zero but is found as follows:

Since the secondary system is isolated its total charge is zero, and therefore: $(V_2 - V_1) C_1 + (V_2 - 0) C_2 = 0$

$$\text{or } V_2 = \frac{V_1 C_1}{C_1 + C_2}$$

where V_1 and V_2 are respectively the potentials of the neutrals of the high tension and low tension windings. C_1 is the capacity between the high and low tension windings; C_2 is the capacity between the low tension winding and ground.

In the ideal case of an isolated transformer, C_2 can be neglected and the potential of the neutral of the low tension winding becomes equal to that of the neutral of the high tension winding or 0.5 (line volts).

When the transformer is in a tank, C_2 becomes comparable with C_1 and the potential of the neutral of the low tension winding becomes less than half the line voltage. As the transformer is loaded C_2 increases, and in the case where a large number of small machines are supplied through the transformer, C_2 becomes large compared with C_1 and the potential of the neutral of the low tension winding becomes zero.

The following experimental results obtained from a 10 kw. 200 to 50,000 volt, 60 cycle transformer bear out the above theory: When tested on 60 cycles with one side of the high tension winding grounded and the low tension winding insulated from the ground the potential of the neutral of the low tension winding, measured with a spark gap, was 53 per cent. of the line voltage, the transformer being out of its tank and standing on a table about 3 feet high. When placed in its tank and immersed in mineral seal oil the potential of the neutral of the low tension winding dropped to 21 per cent. of the line voltage, the tank being insulated from the ground by blocks of wood about 6 inches high. When the tank was grounded this potential dropped to 16 per cent. of the line voltage.

While the secondary potential due to the above cause may be many times the potential for which the insulation of machines operating on the low tension side of the system was designed, yet the amount of power behind this potential is comparatively small, and may not necessarily puncture the insulation, but it will puncture air films in the insulation and cause gradual deterioration due to the formation of ozone.

Report on Fender and Wheel Guard Tests

The Quebec Public Utilities Commission have just issued their report on the car fender and wheel guard tests made at Montreal in November last. The tests were made under the direct supervision of Mr. P. W. St. George, C. E., engineer for the Commission. The fenders subjected for examination were the Conway fender, the Moorehouse fender and the Rose fender. The track used was a straight level stretch of road, with an even and fairly smooth finish of macadam, especially between the rails.

The rules for the award of points in the tests were as follows:—

(1) A complete pick-up or removal of dummy from the track, 4 points; (2) Any part of the dummy remaining under or off the fender or wheel guard but being a partial pick-up or removal, 3 points; (3) If the dummy is for the most part under or off the fender or wheel guard but still a par-

tial pick-up, 2 points; (4) If the dummy is entirely under or off the fender or wheel guard but prevented from passing under the wheel, 1 point; (5) If the dummy passes under the car or wheels, 0 points.

Two series of tests were made at speeds of 8 and 15 miles an hour. At 8 miles the Conway fender gained 21 points out of a possible 96, at 15 miles 11 points out of 96. The Moorehouse at 8 miles made 49 points out of 96, at 15 miles 34 points out of 96. The Rose fender at 8 miles made 41 out of 96 and at 15 miles 36 out of 96. Tests were also made with the Hudson and Bowring wheel-guard used on the Montreal Street Railway system. The tests were not complete but this device at 8 miles gained 43 out of 64 points and at 15 miles 44 out of 64 points.

In conclusion the report states when summing up the advantages and disadvantages of the various devices, "While, therefore, not expressing any preference for the Hudson & Bowring wheel guard, the Commission is of opinion that as a safety and protective device it is upon the whole superior to anything yet brought to the attention of the Commission and which it has had an opportunity of thoroughly examining." The above observations are stated to apply chiefly to streets of comparatively narrow width and with congested traffic such as is generally prevailing in a city like Montreal.

Electric System for St. Jerome, P. Q.

Tenders have been awarded for the hydro-electric system to be constructed at St. Jerome, P. Q., from designs by Mr. Gaspé De Beaubien, Montreal. There was free competition for the work, and the successful tenderers were—Transmission and distribution, Marchand & Donnelly, Ottawa, \$10,875; generators, Swedish General Electric Company, Montreal, \$5,475; switchboards, Hill Electric Switch & Manufacturing Company, \$3,496; water wheels, William Hamilton Company, Peterborough, \$4,743; penstock and concrete work, Laurentian Construction Company, Montreal, \$33,814. The generator equipment consists of two 150 kw., 4,000 volt, 327 r.p.m. waterwheel type units with direct-connected exciters supplied through the manufacturers' Canadian agents, Messrs. Kilmer, Pullen & Burnham.

Maritime Notes

The town of Yarmouth, N. S., has closed a contract with the Yarmouth Street Railway Company and the Yarmouth Power & Electric Company, whereby the lighting and water power equipment of the town will be taken over for a period of ten years. The companies will provide and maintain three hundred lights for the streets, fifty of which are to be 200 watt tungstens, the other 250 to be 60 watt tungstens. All the plant and machinery necessary to operate this system in excess of the equipment already installed and belonging to the town shall be provided and installed by the companies. The town agrees to pay the companies an annual sum of \$8,500 and exempts them from all taxes and water rates.

The Moncton Tramway, Electricity & Gas Company has been re-organized, and the following officers will be in charge during the next year: Robt. Law, Jr., President; E. B. Reeser, Vice-President and General Manager; Dr. Henderson, F. W. Sumner, O. P. Boggs, H. C. Stuart, O. E. Bartlett, directors. Harold N. Price is superintendent of Tramways and Electricity, and A. S. Farmer is superintendent of the natural gas department.

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A Busy Year Promised in Ottawa

C. E. A. Convention in June—E. B. Eddy Installing Large Plant—Ottawa Electric Making Steam Extensions—Will Place Wires Underground

The Canadian Electrical Association meets in convention at Ottawa, June 19, 20 and 21. The meetings will be held in the Chateau Laurier, the magnificent new hotel which the Grand Trunk Railway Co. is just completing. There will be ample accommodation for everybody and elaborate preparations are in progress to make the outing both helpful and enjoyable to electrical men throughout the Dominion.

New Plant for E. B. Eddy Co.

The E. B. Eddy Company, Limited, Hull, Que., are going ahead with large extensions to their plant and at the present time are constructing a large hydro-electric plant for power purposes. The contract for the generators has recently been placed with Messrs. Kilmer, Pullen & Burnham, Limited, sole dealers for the General Electric Company of Sweden, who will build the machines. These consist of three 3,750 kv.a., 2300 volt, 164 r.p.m., 3-phase, horizontal waterwheel type units. No expense is being spared to make the plant strictly up-to-date and first-class in every respect. Work is progressing rapidly and it is expected that the plant will be in operation by the end of the year.

Ottawa Electric Installing Steam Unit

The Westinghouse Company has secured the contract to supply the Ottawa Electric Company, with a steam turbine unit to be erected in the company's steam plant at the Chaudiere. The unit will consist of a 3,200 kw. Westinghouse condensing type, steam turbine, direct-connected to a 4,000 kv.a., 2,400 volt, 2-phase, 60 cycle, 2-pole revolving field generator, running at 3,600 r.p.m. Allowable speed variation of turbine is two per cent.; steam pressure, 150 lbs. at throttle; steam consumption at full load, 17.2 lbs. per kw.; allowable temperature rise of generator, 60 deg. F.; power factor, 80 per cent. The exciter set will consist of one 7 h.p. steam turbine, direct connected to a 25 kw., 125 volt, direct-current generator.

Three Babcock & Wilcox patent water-tube marine-type boilers and latest design chain grate stokers are to be erected. These will provide a heating surface of 4,900 square feet each, and a grate area of 168 square feet. Each boiler, fitted with a Babcock & Wilcox patent integral super-heater with heating surface of 825 square feet, will be capable of evaporating normally 25,000 lbs. of water per hour into steam at a pressure of 200 lbs., from feed water at a temperature of 90 to 100 deg. F. The condenser will be a No. 14 Westinghouse-Leblanc improved type jet condenser, supplied with a special centrifugal water pump and a turbine type vacuum air pump.

Wires to Go Underground

At a recent conference of the Board of Control and representatives of The Ottawa Electric Company and Municipal Electric Department, plans and estimates for putting the wires underground on Sparks street were agreed on. The Ottawa Electric Co. was represented by Supt. A. A. Dion and Dr. L. A. Herdt, of McGill University, Montreal,

and the Municipal Electric Department by Superintendent Brown. The project calls for two concrete tunnels under the sidewalk on each side of Sparks street, six feet high and four feet wide, with manholes at street intersections. The arrangement is to give the Ottawa Electric Company one side of each tunnel and the Municipal Electric Department the other side, while the C. P. R. will string its telegraph wires along the roof. The high tension primaries of the electric companies and the feed wires of the street railway company will be laid in conduit in the floor of the tunnel. Ventilation will be secured through the white way poles.

The debentures will be issued for thirty years based on a cost of construction of \$57,421. Rentals will be as follows: Ottawa Electric Company and Municipal Electric Department, \$1,500 each. Ottawa Electric Railway Company, \$400, and C. P. R. Telegraph Company, \$300.

Electricity vs. Gas for Cooking

A test was recently made under the observation of the Ottawa Electric Company between a Hughes No. 40 electric kitchen range having four rings on the top and a combined broiling and baking oven and a gas stove of similar standard type. The house in which the test was made had previously been using gas exclusively for cooking and averaged 5,500 cubic feet per month. In order to make the trial quite fair the gas stove was taken out altogether so that all the baking had to be done on the electric range. The range was left in for thirty days during which time the conditions of cooking were exactly the same as in previous months. The range cooked satisfactorily except that it was found slower than gas and it seemed more difficult to regulate the heat in the oven. It is stated that probably more practice would have overcome this difficulty.

A meter recorded the electric energy, and a recording watt meter recorded the load for the twenty-four hours. From the latter the loads were found to be as follows: for breakfast a consumption of between 3 and 4 kw.; for noon meal between 4 and 5.5 kw.; for evening meal between 3.5 and 4.5 kw. The greatest load at any time during the month was 5.6 kw.

From the integrating meter it was found that in the 30 days 295 kilowatt-hours had been consumed. Compared with previous gas consumption this means that to replace a thousand cu. ft. of gas requires 53.63 kw.h. of electricity. Taking gas at \$1.25 and electricity at 3c. with 10 per cent. off in each case the cost for one month's consumption as above would be for gas \$6.19, for electricity \$7.97. Extra for electricity 28.7 per cent. To make electricity cost the same as gas at the rate quoted above it would be necessary to sell electricity at 2.1c. per kw.h. However, in making a comparison of these again, the advantages of electricity for cooking, such as cleanliness, convenience and safety must be considered.

The above test it must be understood was made under the direction of a company which controls both the gas and the electric services of the city and sell both gas and electric appliances. It follows that there would be no reason to make one set of figures more favorable than another. The fact that during the first month's trial electricity could make so favorable a showing would indicate that with longer experience and more skilful attention the difference could be very much reduced if not entirely eliminated, even under the conditions outlined above.

Electrical Activities in British Columbia

New Terminal Station for B. C. E. R.

The British Columbia Electric Ry. Co. is erecting in Vancouver a handsome building calculated to accommodate the Canadian head offices of the company, and serve as a tramway terminal for their extensive suburban system.

The location of the building is in the heart of the business district of Vancouver, at Carrall and Hastings streets. In 1898 the company purchased from the C.P.R. a plot of land on the corner of which was erected a two-storey brick building which then met the demands for head office and interurban station accommodation. When the development of the company's business necessitated the securing of enlarged quarters, a business block adjoining the old station on Carrall street was purchased and this site included in the building plans. Since the new structure was started the company has made further purchase of adjoining property, fronting on Pender street, which will permit of the further extension of its quarters as the need arises.

The plot is irregular in shape owing to the fact that the C.P.R. line, which crosses the city of Vancouver, extends in a diagonal direction along the west side. The building will have a frontage of 190 feet on Carrall street, 70 feet on Hastings street, 216 feet along the C. P. R. tracks, and 200 feet on the south side. From this south side connection can later be made with any extensions the company may plan on the Pender street property which it recently acquired.

Work on wrecking the old buildings on the plot was started on March 16th last and actual construction on the new structure was begun on June 29. Operations have been pressed vigorously since that date and the company expects to occupy the new quarters by midsummer of the present year.

The block will be 80 feet in height from the ground, provision being made for a basement, high ground floor and five storeys for office purposes.

As will be seen from the illustration the building is of an imposing architectural type. In general it will be of reinforced concrete construction with a granite base on the ground level. On the Hastings, Carrall and C.P.R. frontages it is faced with wire cut light grey pressed brick, this face being relieved with rich ornamentation of terra cotta. Further ornamentation is given the street elevations by the placing of ornamental iron face plates on the structure, forming the sills and lintels of the windows. Over the pilasters of the ground floor is placed a heavy 4-inch belt course of terra cotta and above the level of the fourth storey is a heavy cornice, 5 ft. high and with a projection of 3 ft. for the illumination of the structure by powerful lights located in the cove of this cornice. In the basement, which will be 9 ft. 9 in. in height, are located rooms for the trainmen, lavatories, heating plant and storage rooms.

The ground floor will be 24 ft. in height. On the Hastings street frontage provision is made for the interurban tram trackage leading to the large train shed on the west

side of the building. Three entrances to this train platform are provided from Carrall street. The shed itself is 50 ft. by 128 ft. in size. Its roof is formed on five heavy steel trusses in which girders 5 ft. 6 in. in depth and giving a span of over 50 feet are used. The office quarters are built over the Hastings street frontage of the train shed, but the greater part of the area is left clear above, being lighted through a roof of heavy wire glass.

The first, second and third storeys will be 12 feet high and the fourth and fifth storeys about 11 feet high. About 15,000 sq. ft. of floor space is provided on each of the office floors. Throughout, the structure is being built according to the highest standard of fireproof construction. The wood finish of the interior will be of oak. The plumbing is of the Durham type and the heating installation of the steam vacuum type. The total cost is estimated at \$420,000.

The plans for the building were prepared by Messrs. Somervell & Putnam and the work of construction is being carried on by Messrs. McDonald & Wilson under the direction of Mr. R. W. Bridge who is acting as Inspector on



New Terminal Station B. C. E. R. Co.

the structure for the British Columbia Electric Railway Company.

Prince Rupert Hydro-Electric Company

An agreement has been reached between the G.T.P. Railway Co., the G.T.P. Development Co. and the Prince Rupert Hydro-electric Co. whereby the hydro-electric company is allowed to erect their transmission lines over the right-of-way and lands of the two former companies from the site of the power plant on Khtada River to the town of Prince Rupert and to Porpoise Island, where many new industries are to be started. From present indications there will be sufficient demand for power to keep the electric development company busy as soon as they can be prepared for delivery. The Provincial and Dominion governments will require power in connection with their wharves and docks; a number of lumber mills, brick works, cement works, flour mills, smelters, etc., are being established and negotiations are under way for the supplying of the G.T.P. with all the power they will require in connection with their terminal station at Prince Rupert, which will be very considerable.

Work at Lake Buntzen

Rapid progress is being made by the B. C. E. R. Co. on the extensive development work planned for their hydro-electric station on the North Arm of Burrard Inlet during the present season. At the present time about 900 men are at work on the various parts of the undertaking, and when the outside working season is at its height this number will be increased to 1,300 men, the monthly payroll of the force—the greater part of which will be spent in Vancouver—amounting to a tidy fortune.

At Lake Buntzen operations are now being pressed vigorously, in preparation for the construction of the new power house which will house the three large generating units, each 14,000 horse power, the contracts for which were awarded in January.

This building will be located about 2,000 feet south of the present generating station, the plans calling for a building which will conform in general with a model plant now in operation at this point. Already 40,000 cubic yards of solid granite have been cleared away to prepare the site for the new station, and this clearing work is still in progress.

The arrangements for the new station require the boring of a great tunnel through the granite ridge separating the waterfront site from the dam at the outlet of Lake Buntzen. This tunnel will have a length of 2,250 feet, and an internal diameter of 15 feet 6 inches. Considerable progress has already been made, about 320 feet having been driven, and preliminary work having been done for the prosecution of the work through several shafts 75 feet in depth. When completed, the tunnel will be lined with concrete to reduce the friction factor to the lowest limit, and water will be delivered to the power house at a head of 400 feet.

The generating equipment which will be placed in the new station, consists of three Doble waterwheels, each of a capacity of 14,000 horse power, the largest of their type on the continent, which will be supplied by the Caledonian Iron Works, and three electrical units, each of 9,000 kw. capacity, and capable of an overload equal to the hydraulic equipment. These are being supplied by Dick, Kerr Company. This equipment will increase the company's possible output from its North Arm generating station to 85,500 horse power.

Last year work was completed on the enlargement of the hydraulic tunnel connecting Lakes Buntzen and Coquitlam, through which the water for the operation of the generating station flows. This bore, of over two miles in length, was increased in size from 9 x 9 ft. to 12 x 16 ft., the undertaking being so extensive as to take several years for completion. In connection with the work a new forebay and intake was constructed at the Lake Coquitlam end to provide for the additional flow of water which will be accommodated by the enlarged tunnel.

At the Lake Coquitlam end of the company's workings 450 men are now employed and work is being steadily pushed in connection with the construction of the great dam at the outlet of the lake and the tasks resulting from this development. On the dam itself considerable progress has been made, from 40,000 to 50,000 cubic yards of material having been placed in the toe wall, and such advance made in general as to justify the hope that the great work will be completed during the present year. The tunnel for the diversion of the river, which will be 28 by 18 feet in size, is now about completed, and the work of cement lining on it is in progress.

The foundations for the new water tower which will form the intake for the water supply of New Westminster, are well advanced, and the tunnel through which the water supply of the Royal City will be turned is practically com-

pleted. It is expected that within a short time the new connections with the New Westminster water main can be made. The extensive clearing operations inaugurated by the company last year on the portions of the lake which will be flooded when the new dam is in service, have been renewed, a large number of men being engaged on this work.

Lighting System, Cambie Street Bridge, Vancouver

A short time ago the third steel bridge over False Creek, in the city of Vancouver, was opened for traffic. The bridge is known as the Cambie Street Bridge and connects Cambie street on the north to Bridge street on the south. The length is approximately one mile. As the bridge is arranged for street car traffic, special attention had to be given to the lighting system. This was all the more necessary as the system used on the first bridge on Granville street had not proved satisfactory.

The first plans and specifications drawn up provided for standards on both sides of the bridge 90 feet apart, these standards being arranged for the trolley span wires, and a cast iron bracket arranged for supporting one 80 watt tungsten lamp, the lamp specified being 110 volt multiple type and the system 3-wire run in conduit on each side of the bridge. As the vibration caused by the cars on the bridge was found to be excessive on Granville street, the specifications were changed and a series tungsten system adopted. The standards were kept the same, but series fixtures supplied by the Canadian General Electric Company were installed. These fixtures are provided with a film cut-out to close the circuit in case a lamp burns out. The lamp adopted is an 80 watt 6.6 amp., and in order to supply constant current for these lamps, series regulators were provided. There are two of these, being $4\frac{1}{2}$ kw. each, one being kept for spare. These regulators are installed at the city incinerator at the south end of the bridge. The installation further consists of switchboard, with an oil switch and wattmeter, together with separate panels for each regulator. The power at present is being supplied by the B. C. E. R. Co. at 2,200 volt. The intention is to use any excess power which may be obtained at any future time from the incinerator for supplying light to the bridge. The system has so far been a great success, the breakage of the lamps being very small. There are altogether 88 standards, 44 on each side. The draw span is lighted by ten one-light brackets, fed from a 500 volt circuit, lamps being 75 watt, 110 volt, in series, five on each side. All brackets are structural steel. All wiring for lighting is lead encased cable drawn in galvanized steel conduit.

Western Canada Power

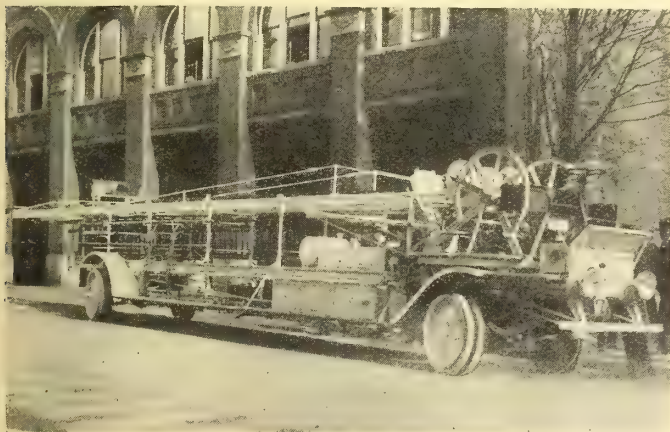
In presiding at the annual meeting of the Western Canada power Company, Limited, held in Montreal, recently, Mr. C. H. Cahan, K. C., stated that the hydro-electric plant of the company had been in operation for three months. They had contracts for over 15,000 h.p. and negotiations were pending for 5,000 h.p. additional, while Mr. R. F. Hayward, the general manager, was confident of securing within the near future, contracts for a total of 14,000 h.p. for delivery within Canadian territory, exclusive of the contract with the Whatcom County Railway & Light Company, which called for the delivery of approximately 5,000 h.p. to 6,000 h.p. at the international boundary, at Sumas, for consumption in the State of Washington, U.S.A.; the intake dam at Stave Falls was already fitted for two extra penstocks; the power house could easily be extended for installing two more generating units of the same capacity as each of the existing units and the power house site and tailrace have been excavated for the complete installation of four units, capable of generating 12,500 h.p. each, at a load factor of 85 per

cent. The company could double up this installation at the lower site and thus produce 100,000 h.p. Without further extensions they could produce power up to their present capacity of 25,000 h.p. at about one-half the cost of production of any known competitor.

The company have now erected 35 miles of double main transmission line designed for 60,000 volts; 50 miles of 12,000 volt feeder lines; 38 miles of 2,000 volt distributing lines; and will soon have completed laying ten miles of underground mains in the heart of the city of Vancouver, capable not only of supplying power, but also of supplying desirable electric lighting business of that city, in case the directors should hereafter decide to compete in this line. At present they were restricting operations to the supply of power for industrial purposes. The retiring board of directors were re-elected, and Mr. R. F. Hayward, general manager of the company, and Mr. A. H. B. MacKenzie, were added to the board.

Gas-Electric Fire Truck

The first electrically driven aerial truck to be acquired by the Vancouver Fire Department, arrived in the city recently. The truck is driven by four electric motors for which power is furnished by a 6 cylinder, 4 cycle, 70 h.p. gasoline engine, direct-connected to a 6 pole interpole, direct current dynamo, all operated by the driver from his seat. The ladder, which is 85 feet long when fully extended, is raised electrically by separate motor, geared to



Gas-electric truck, Vancouver fire department.

a quadrant. The fly-ladder, or extension, is operated by a cable and drum, and the complete ladder is mounted on a turn table, so as to swing to any position. The truck overall measures 51 feet, and represents an outlay of \$15,000. The Webb Motor Fire Apparatus Company, St. Louis, Mo., manufacturers, supplied the truck, through Brown-Jamieson, the Vancouver agents.

Earl's Road Substation

The engineering department of the B. C. E. R. has completed its outline for the electrical equipment of the new Earl's Road sub-station on the New Westminster Inter-urban line, Vancouver. This equipment consists of two 1,000 kw. motor generator sets, two banks of transformers of 3,000 kw. each for light and power service, eight arc regulators, with a total capacity of 800 lamps, and a switching station for a 10,000 volt feeder switch. This equipment will be placed in a reinforced concrete structure, 70 x 86 feet in size, to be located on Earl's Road. The main building will be one storey, with an additional half-storey at one end for a transformer gallery. The total outlay will be \$125,000. The work forms another step in the elec-

trical progress of the B. C. E. R. Company. Operations are now under way for doubling the capacity of sub-stations at Lulu Island, New Westminster, Point Grey, and the large station in Vancouver. It is the intention of the company to also double the capacity of Burnaby station.

Tram Line to Delta

The project of an electric tram line from New Westminster south to Delta, took concrete form lately when General Manager Sperling, of the B. C. E. R. Company, agreed to have the company's surveyors make a tentative survey of the proposed route which, it is understood, will connect with the Fraser Valley line at the most convenient point, probably in the vicinity of Kennedy station. The company is apparently convinced of the advisability of reaching out for the Delta trade, and there are no considerable engineering difficulties to be surmounted on the proposed route.

Bull River Power Co.

At a point on the Bull River, convenient to Cranbrook, B.C., the Bull River Power Company have constructed a dam for power purposes. This dam has a length of 400 feet, with an elevation of about ten feet. A flume a mile and three-quarters in length, 16 feet in width, and 6 feet in depth has been constructed, and contracts let for the erection of a power house, and the installing of turbines and dynamos capable of generating 12,000 horse power. This company will supply electric power to towns in the Crow's Nest Pass district as far east as Hosmer, and west to Cranbrook, Moyie, and Fort Steele.

Miscellaneous

Alterations and additions costing about \$25,000 are to be made to the auxiliary power plant of the British Columbia Electric Railway Company, on Store street, Victoria.

The council of Richmond municipality, in the Fraser Valley, is discussing the advisability of acquiring the Farmers' Telephone Company and operating an extended municipal system in opposition to the British Columbia Telephone Company.

City Electrician Thomas, of Nelson, B.C., has been instructed to purchase 270 meters of various types from different firms, the idea being to give the meters a twelve months' efficiency test before placing an order for the large number required for the various services.

Citizens of Merritt, B.C., are supporting the town council in a scheme to install an electric lighting plant and waterworks system. Plans for both installations are now being prepared by Dutcher, Maxwell & Company, Vancouver. The approximate cost of the lighting plant is placed at \$20,000.

Mr. L. G. Robinson, who has been acting as assistant to chief engineer Conway, of the British Columbia Electric Railway Company, has resigned, and will enter into practice as a private consulting engineer in Vancouver. Mr. Robinson came to the B. C. E. R. from Eastern Canada, where he held appointments with the Shawinigan Water & Power Co. and the Ontario Power Co., later being engaged in private practice as a consulting engineer at Niagara Falls. Among other work at the coast he acted as assistant to Mr. Le Baron in the scheme for the reclamation of land about Sumas Lake, B. C.

Montreal and the Eastern Provinces

Drummondville Enlarging Plant

As briefly stated in our last issue, the town of Drummondville, P.Q., is enlarging its power house and electrical plant, the general contractors being the Bishop Construction Company, Montreal. About six years ago the town installed a small plant, and the additions now decided on will bring up the total power to 850 horse power. The energy is required chiefly for supplying power to various industries which are located in the district, and also for lighting purposes. Drummondville is situated on the River St. Francis, and there is sufficient water power available to develop between 5,000 and 6,000 horse power. The additions to the plant include a 275 horse power water-wheel, to be supplied by the William Hamilton Company, of Peterborough; a 150 kw. generator with Lombard governors and alterations to the switchboard, the contract for this equipment having been placed with the Allis-Chalmers-Bullock Company.

The water-wheel will be of the wicket gate type, and operate under 10-foot head, mounted vertically in casing, stuffing box outlets for main and cover shaft, bevelled gear with removable maple cogs and cast iron pinions being provided. The water-wheel will have an efficiency of at least 85 per cent. at three-quarter load when running under good conditions. The governor will move the gates from completely open to completely closed in five and a half seconds. The two gate hoists will be capable of lifting 5 ft. by 8 ft. gates 10 ft. head, the operating beam of gate being 6 by 8 in. with operating arms. The generator is to be 60 cycle, 3-phase, 2,300 volts, 257 r.p.m., revolving field water-wheel type, with two bearings directly connected to water-wheel gears, and the full efficiency is to be not less than 93 per cent. and 89.9 per cent. at half load. A belted exciter of 125 volts, compound wound, of a capacity not exceeding 5 kw., the excitation required by the generator, will be also provided. The switchboard is designed so that the two generators may run in parallel, and the exciters are arranged with double throw field discharge switches so that either or both of the generators may operate with either of the exciters. All 2,300 volt bus bars are insulated throughout their whole length and are of sufficient size that current density will never rise over 600 amperes per square inch. Twelve single pole non-arcing spark-gap lightning arresters are to be fitted, while all instruments will be of the horizontal type not less than 9 inches wide, dead beat, accurate within two per cent. throughout their useful range. The switchboard comprises two generator and one feeder panels. Mr. Gaspe de Beaubien is acting as consulting engineer for the town.

Dorchester Electric Co.

Mr. W. T. Wilson, Assoc. Mem., C.S.C.E., of the engineering staff of the Montreal Light, Heat & Power Co., has been appointed general manager and chief engineer of the Dorchester Electric Company, Quebec, who have obtained the contract for the lighting of that city and also a number of five and ten year contracts for power from private firms. Mr. Wilson is a native of Dregthorn, Scotland, and graduated in the science and arts school, Kilmarnock, in 1894. For five years he did general engineering work, and in 1899 came to Canada, joining the staff of Mr. J. E. Vanier, C.E., Montreal, with whom he stayed three and a half years. In August, 1902, Mr. Wilson went to the Montreal Light, Heat & Power Company, and during his connection with that organization supervised the erection of their portion of the

Shawinigan Company's sub-station in Maisonneuve and installed the apparatus in the same. He also supervised the erection of the Mentana street station for the Soulanges Power Plant of the Provincial Light, Heat & Power Company, which is a subsidiary of the Montreal Light, Heat & Power Company, and was resident engineer there for four years and during the complete construction of this plant which is of 20,000 h.p. capacity. Mr. Wilson further rebuilt a break in the St. Therese dam; built one mile of the retaining wall in the River Richelieu at the Chambly power house; and for the last year has been in charge of construction for the Montreal Light, Heat & Power Company. During this latter period he has been engaged in engineering work and in making reports on the various propositions submitted to the company. Mr. Wilson was also asked to take charge, as resident engineer and superintendent of construction of the Cedar Rapids project, which is being carried out by the Shawinigan Light & Power Company, in conjunction with the Montreal Light, Heat & Power Company, where it is proposed to develop 120,000 h.p.

The Dorchester Electric Company is being financed by Alderman J. Robinson, of Montreal, president, and other capitalists. The Montreal Light, Heat & Power Company were reluctant to let Mr. Wilson go, but the position he has accepted was too attractive to be refused. Prior to leaving for Quebec, Mr. Wilson was presented by the staff of the Montreal Light, Heat & Power Company with a Gladstone bag and a set of toilet cases. The presentation was made by Mr. Herbert Carbary. Mr. J. S. Norris, the general manager of the company, and Mr. R. M. Wilson, general superintendent and chief engineer, also made congratulatory remarks.

Wiring Conditions in Quebec City

The Canadian Fire Underwriters' Association, through Mr. James Bennett, chief electrical inspector, appeared before the Quebec Public Utilities Commission, in Quebec city, on the 11th inst., in connection with complaints made as to the electrical conditions existing in that city. Mr. Bennett said that the conditions as to overhead wires were dangerous and a menace to life; in some places the wires of the telegraph companies were placed on poles belonging to the Quebec Railway, Light, Heat & Power Company, creating a hazardous condition; there were also a large number of call boxes in business places without any protective devices and these were not installed in a proper manner. He asked that the defects be remedied, in accordance with the rules of the National Electric Code.

The Commissioners dealt with the defects in the equipment of the Quebec Fire Alarm Department, the C. P. R. and G. N. W. telegraph systems, and the Quebec Railway, Light, Heat & Power Company, and examined a series of photographs taken to show general and specific conditions. The Commissioners agreed with the methods of protection suggested by the Fire Underwriters, and ruled that within ten days all the systems complained of must be rigidly inspected by the companies and the defects rectified. The Commissioners also ruled that where the lines of different companies cross at right angles or parallel one another when not on the same poles a minimum separation of 36 inches must be maintained; where they are held upon the same poles a minimum distance vertically of 26 inches will be required; and where they are on the same cross-arms a separation of 24 inches must be maintained. The lines of the Quebec Fire Alarm Department must be removed from

those poles of the Railway, Light, Heat and Power Company upon which high tension wires are carried; also that all telegraph call boxes, manual fire alarm boxes, and other such appliances installed on the inside of buildings, must be protected, as required by rule 85 of the National Electric Code.

The question of grounding the secondaries of the Q. R. L. H. & P. Company is proceeding, and other defects are receiving attention, the company having agreed to conform to the requirements of the Fire Underwriters. The Commissioners recommended to the city of Quebec, through their city engineer, at the earliest date to appoint an electrical commission with instructions to lay out underground ducts and to supervise the installation of all wires therein, and that the poles be removed from the streets and lanes of the city as soon as possible.

Changes in National Code

At a meeting of the electrical committee of the National Fire Protection Association held in Boston, recently, at which Mr. James Bennett, chief electrical inspector, Canadian Fire Underwriters' Association, Montreal, was present, it was unanimously decided to make the following changes in the National Electrical Code, which changes will be incorporated in the forthcoming edition of the Code to be issued in 1913:

Rule 38-u-6 is amended to read: "Motion picture machines especially approved for motor operation may be permitted by inspection departments having jurisdiction."

Rule 15-a is amended to read "Neutral wires must be grounded and the following rules must be complied with: (Section 1, 2, and 3 unchanged). The two foot notes are omitted.

Rule 15-b is amended to read "Transformer secondaries of distributing systems must be grounded, provided the maximum difference of potential between the grounded point and any other point in the circuit does not exceed 150 volts, and the following rules must be complied with: (Sections 1 and 3 unchanged). Section 2 is amended to read "When no neutral point or wire is accessible, one side of the secondary circuit must be grounded." Fine print note (Inspection Departments having . . .) is omitted. A new paragraph to be known as 15b-4 is inserted, to read as follows: "Where the maximum difference of potential between the grounded point and any other point in the circuit exceeds 150 volts, grounding may be permitted."

A fine print note to be added after 15g to read as follows: "Companies and departments having charge of water-works are urged to allow the attaching of ground wires to their piping systems in the full confidence that the integrity of such piping systems will in no way be affected, whatever the normal voltage."

Justice Issues Restraining Writ

Mr. Justice Charbonneau has ordered the issue of a writ of injunction restraining the shareholders and directors of the Dominion Light, Heat & Power Company, Limited, from holding a meeting to authorize the issue of \$1,000,000 thirty year, five per cent. debentures. The injunction was at the instance of Mr. L. G. Read, a shareholder, who objected to the proposed allocation of \$600,000 in debentures and 9,000 fully paid shares of the common stock to Messrs. A. Michaud and Oscar Dufresne, in payment of the company's indebtedness to these gentlemen. It was stated that there were only a small number of fully paid-up shares of \$100 in the company, and the judge held that the company could not borrow, either by debentures or otherwise, an amount exceeding the sum of its fully paid-up shares. Considering

the large amount to be allotted, the shareholders ought to have an opportunity to consider whether such an allotment was justified.

Following this action, Mr. Reid, who is manager of the Colonial Engineering Co., has filed a petition for the winding up of the Dominion Company on the ground that this company is unable to pay the sum of \$1,354 which it is claimed is due to the petitioner for services rendered and goods sold.

Quebec Electrical Association

The monthly meeting of the Electrical Association of the Province of Quebec, held in Montreal, on April 12th, was presided over by Mr. C. Thomson. A report on the compulsory licensing of contractors has been prepared by a committee, but in view of the importance of the subject it was decided to hold a special meeting to discuss it. A committee appointed at the previous meeting reported in favor of amending the by-laws in order to admit associate members, who, however, should not have power to vote; journeymen and apprentices, it was suggested, should not be eligible. The fee for associates was fixed at \$2. The report will be considered at the next meeting.

At the close of the business, Mr. H. O. Blatt, shop superintendent of the Imperial Wire and Cable Company, Montreal, read a paper descriptive of the manufacture of rubber covered wire, dealing more particularly with the process of preparing the rubber compound and covering the wires. He stated that the company were bound to use the purest Para rubber, and also remarked that under the New Code the compound would have to be of a higher grade.

Several questions bearing on the process of manufacture were asked, and in the course of an informal debate the relative merits, from the endurance point of view, of British and Canadian wires were discussed. Mr. Blatt stated that the thin British wire was covered with pure Para rubber, and expressed the opinion that wire manufactured in Canada and covered with compound was more durable.

Electrical Conditions in Three Rivers

At the request of the Corporation of Three Rivers, P. Q., Mr. James Bennett, chief electrical inspector of the Canadian Fire Underwriters' Association, Montreal, has made a report on the electrical conditions in that city. A special inspection of the overhead line construction and of the interior electrical conditions was made, and Mr. Bennett reports that generally on the overhead system of wires, a very dangerous condition exists due to careless and improper methods of construction. There is a multiplicity of what are supposed to be dead wires which are not maintained in a safe condition and are liable to make accidental contact with wires carrying 2400 or other voltages. The guy-wires passing between high and low tension wires without insulators are dangerous to the public. Primary leads connecting with transformers are not sufficiently supported. Mr. Bennett also states that the l.t. transformers are not grounded, and that the voltage though about 120 at the station varies during hours of peak load from 104 to 112 in the commercial parts of the city, showing faulty distribution. The interior installations exhibit an especially poor class of construction; defects are common and in certain cases bell wire has been used for interior wiring. Mr. Bennett recommends that the lighting company be instructed to remedy defects on their construction without delay.

Mr. J. W. Moncur, Montreal manager of Canadian Tungsten Lamp Company, and Mrs. Moncur, spent Easter in Hamilton.

Moveable Property Not Subject to Tax

Mr. Justice Greenshields, sitting in Montreal, on April 9th, decided that the poles, wires, pipes, transformers and other service equipment of a lighting company are not immovable property, and cannot be taxed as such. Accordingly he dismissed a suit brought against the Montreal Light, Heat & Power Company by the city of Westmount. His Lordship also ruled that the municipality, under its existing charter, had no right to impose a business tax on the company, and hence the suit was also dismissed on this score. The amount involved in the litigation was \$4,082.80. In support of its right to impose a special business tax on the company, the municipality represented that the latter was doing a regular business within the limits of the city, and thus in this connection was the lessee and tenant of gas mains and electrical transmission equipment from which it derived profit. Hence, it was subject to the same laws as governed other businesses. The company, on the other hand, pointed out that the statute under which the municipality had enacted a by-law imposing a tax on the company was non-existent, since the municipality had obtained a charter as a city. Thus, as the statute had been abrogated, the by-law based on that statute was automatically repealed.

Montreal Tramways & Power

The Montreal Tramways and Power Company have sold to Potter, Choate and Prentice, of New York, \$5,000,000. three year six per cent. collateral trust bonds, the security consisting of a pledge of \$6,000,000 debenture stock of the Tramways Company and additional collateral carrying the voting stock control of allied companies as follows: 10,400 shares of the common stock of the Montreal Tramways Company, 39,000 shares of the common stock of the Canadian Light & Power Company, 875 shares of the common stock of the Saraguay Electric & Water Company. The present financing will result in the retirement of all floating indebtedness of the Montreal Tramways & Power Company.

It is officially stated that the capitalization of this company consists of \$15,753,700 common stock, \$5,000,000 three-year 6 per cent. notes now issued, and \$1,350,000 similar notes previously issued. The Canadian Light & Power Company are said to be taking steps to increase their development from 22,000 horse power to 30,000 horse power and ample funds are available for this extension. The Tramways Company require approximately 30,000 horse power, with a rate of increase of about 12 per cent. per annum.

Conflict of Authority

There is, in Montreal, a conflict of authority as to the erection of poles by the electric lighting companies. Under a by-law passed in 1905 Mr. Barlow, the superintendent of the road department, forbids the erection of poles, but his authority is of no avail as the companies have obtained charter powers at Quebec and place the poles wherever they desire. Mr. Barlow suggests, pending the construction of underground conduits, that the by-law should be amended in such a way as to permit the city to indicate where the poles should be placed, as often a choice of site is in the interests of the city.

St. Paul Electric Light Co.

The St. Paul Electric Light Company has failed in an attempt to obtain an injunction restraining the Montreal Light, Heat & Power Company from operating within the limits of Emard Ward (formerly Ville St. Paul). The case is interesting from the viewpoint of the validity of agreements entered into with the former municipal authorities and the effect upon them of annexation to the city. It was

contended by the St. Paul Company that their pre-annexation privileges were exclusive, while the Light, Heat & Power Company argued that the charter obtained from the provincial parliament authorized them to operate within the city and construct transmission equipment in all municipalities within a radius of 100 miles of the city. These charter rights were not, it was said, invalidated by the acts of annexation. Mr. Justice Charbonneau, in refusing the injunction, decided that the exclusive rights claimed were at least doubtful, and suggested that the proper mode of procedure was by way of a claim for damages, when the merits of the dispute could be argued. Acting on this suggestion, the St. Paul Company have entered an action for \$10,000 damages against the Montreal Light, Heat & Power Company.

Westmount Again Reduces Rates

The city of Westmount has announced another reduction to 7c. per kilowatt hour on all five-year lighting contracts, the one-year contracts remaining at 9c. The price of lighting municipal buildings has been placed at 5c. In the annual report of the city, it is stated that the profit for the year ended October 31st last amounted to \$4,758. In that period the rates for public and private lighting were reduced by over \$8,000, but even with this the earnings of the plant increased, owing to additional customers and the more general use of heating apparatus. The total earnings were \$97,400. as against \$86,557 in the previous year, but the net profits declined by \$1,200. The city operates an electric destructor plant, and last year 17,008 tons of refuse were disposed of at a cost of \$10,249, or 60c. per ton, this including the fixed charges.

Sell Out to Private Company

Following the decision to withdraw from supplying light to Lennoxville, the city council of Sherbrooke has decided to sell to the Lennoxville Power Company all their property in Lennoxville, including poles, wires, transformers, goodwill, etc., for \$10,000. The council has also agreed not to sell light or power in the city for five years, and the company have, on their side, agreed to sell light and power to the consumers at the same rate as is now in force.

Proposed Wireless Extensions

A special committee of the Westmount, P.Q., Corporation has reported in favor of putting the electric wires underground, there being 10,000 miles of wire to be dealt with. The committee is in favor of conduits being constructed on all streets, and the report has been referred to another committee which is conferring with the companies interested.

Fire Did Not Delay Business

Fred Thomson & Company, Manufacturing and Contracting Engineers, Montreal, advise that though a recent fire damaged a portion of their establishment and necessarily inconvenienced them for a short time, they are already again in full operation and are in a position to attend promptly to all orders.

Mr. Laurent G. Morin, of Montreal, has been appointed secretary-treasurer of the East Canada Power & Pulp Company and the Labrador Electric & Pulp Company, with Mr. Joseph Duguay, of Murray Bay, as assistant. Mr. Lewis C. Haskell has resigned the position of secretary-treasurer to these companies to go into the real estate business.

The Canadian Electrical Association holds its annual convention in Ottawa on June 19, 20 and 21. The Chateau Laurier will be ready for the accommodation of the delegates.

Canada's Busy Prairie Provinces

Important Developments in Calgary

Important developments in the extension of the electric light and power system of the city of Calgary have taken place during the last few months.

The new sub-station equipped with three 1,000 kv.a. Westinghouse transformers, 12,000 to 2,300 volts, was put into commission last month, also the underground 12,000 volt cable supplied by the Imperial Wire & Cable Company. There has also been installed by the same company, about two miles of 300,000 circular mil, paper insulated, lead covered cable, 2,300 volts, for distribution purposes, and with the successful inauguration of the underground feeder system, a great improvement, both in power and lighting, particularly in the outlying districts, has been accomplished. During the past three months, 960 new light connections, and twenty power connections have been made, totalling 1,500 h.p. During the past month two 75-light magnetite arc equipments arrived in the city from the Canadian General Electric Company, one of which has been put in service, and the other one is being installed. Greater attention is this year being directed to street lighting, than in the past, owing to a general demand for improved lighting, and it is expected that the city will shortly install a number of ornamental standards along the business streets. At this time of writing, a definite policy as to how the cost of maintenance and installation should be apportioned between the property owners and the city, as a whole, has not been arrived at.

Tenders were received March 20th, on a large amount of electrical machinery, and the contract for a 2,500 kilowatt turbo-generator set, including condensers, piping, etc., has been awarded to Messrs. Laurie & Lamb, for a Belliss & Morcom turbine, direct connected to a Vickers' generator; also to Messrs. Kilmer, Pullen & Burnham, one 1,000 kilowatt Swedish auto-synchronous motor generator, for supplying power for the operation of the street railway; also one 25 kilowatt exciter set to the Allis-Chalmers-Bullock Company, and to Ferranti, Limited, through their agent, P. D. McLaren, Calgary, one 13-panel 2,300 volt switchboard, and one 4-panel high tension, including lightning arresters and installation; to the Canadian Westinghouse Company, two 3-phase, 3,000 kv.a., 12,000 to 2,300 volt transformers, which are to be installed, together with the switchboards and motor generator in the new up-town sub-station, for which tenders are now being called for the construction.

The Babcock & Wilcox water tube boilers, for which contract was awarded early in January, having a capacity of 2,000 h.p., have arrived in the city and preparations are now being made for the installation of the same. The boilers are equipped with super heaters and chain grate stokers and, with their installation, together with the new steam turbine above referred to, the power house constructed last year, and now used as a stand-by or auxiliary, to the water power plant, will be filled to its capacity. Some twelve miles of conduits for the electrical department will be installed during the coming year, and contracts have already been awarded for ducts, to the Northern Electric Company, and to the General Supplies in this city.

While it is not the intention to place all the overhead wires underground immediately, yet it is considered good policy to have the underground work completed before the permanent pavements are laid, and thus avoid tearing them up later on. This has been the policy of the Calgary Electric Light & Power Commission for the past two years, and approximately ten miles of streets have been provided with conduits.

Construction has already started on some twelve miles

of new track to be laid in this city, and a number of 41-ft. double truck cars have arrived in the city from Preston, and others are expected from the Ottawa Car Company, very shortly. The receipts of the street railway for last month were \$39,884.05, as compared with \$22,759.21 for the corresponding month last year, which goes to show the enormous development which is taking place in this city. The basis of an agreement has also been entered into with the South-East Calgary Land Corporation, who are constructing about nine miles of track to develop fertile district, and provide homes for many people who prefer to live on small holdings in the suburbs. This railway will connect with the track about to be constructed to the new Canadian Pacific Railway Car Shop District, and in all probability, power will be supplied for the operation of the same by the city's power plant.

The Electric Vehicle in Winnipeg

Winnipeg, with its miles of paved streets and absence of grades, is an ideal place for the electric car, and indications are that it will soon come into its own in that city. A year ago there were not more than a dozen electrics running on the streets, and there are now about fifty in regular use, of which twelve are commercial trucks, with eleven more trucks now on order. With the increasing demand for electric vehicles there is also the need for better garage facilities, and to that end ground was broken recently on Carleton street near the site for the Free Press building for a two-storey electric garage for the Larimer Company, who under the management of R. G. Larimer, are exclusive agents for the Detroit Electric and the Edison battery.

This building will be 121 feet by 60 feet, and will accommodate with charging facilities, 75 cars and trucks. An electric elevator will carry the cars to the second floor and to the basement. The show rooms and office will be located on the first floor, and also the switchboard and motor generator set for furnishing the charging current. This motor generator set will be of Siemens manufacture, and will comprise a 115 h.p., 880 r.p.m., 3-phase motor and a 77 kw., 110 volt interpole shunt wound d.c. generator. It will be controlled by a ten-panel switchboard which will be equipped to charge or discharge twenty cars at one time. The charging receptacles will be located on the walls of the garage, and leads laid on the floor will carry the current to the car under charge. This garage will be thoroughly modern in all of its appointments and will be on a par with any electric garage in the United States. There are a large number of private garages in the city which are equipped with mercury arc rectifiers, and the Fort Rouge garage, which has hitherto catered only to the gasoline cars, will install a motor generator set and switchboards for charging electrics.

The electric truck equipped with the Edison batteries has become very popular with merchants, wholesalers and others, as may be noted from the list of those in use during the past winter;—Winnipeg Paint & Glass Co., two 1-ton trucks; A. MacDonald Wholesale Grocery, one 2-ton truck; J. Leslie Furniture Company, one 1-ton truck; G. F. Stevens Paint and Glass Company, one 1-ton truck; The Royal Mail for transporting mail from office to the trains, one 1-ton truck. In addition to the above there are about eleven of these trucks now on order, a number of which are repeat orders. The Winnipeg Electric Railway Company has just placed an order for two one-ton trucks, one of which is an emergency tower wagon, and the other a one-ton truck for

general utility work. These will be kept in a private garage, and if they prove as satisfactory as is anticipated, a number will probably be ordered before the year is out. The City Light and Power Department is also considering the purchase of electric trucks for cable and emergency work. Considerable trouble was anticipated with the Edison battery during the cold weather, but from the claims of those who own these trucks, no great fault could be found with their performance during the 40-degree below zero weather of the past winter.

The Larimer Company charge \$30 per month for taking care of the trucks. This includes washing, polishing, charging, and minor repairs, and the storage. For pleasure vehicles the charge is \$35, and this includes the delivery to the owner's house. At the present rates for power the cost



The electric truck very popular with merchants

for operating a truck works out to be about 1.7 cents per ton mile of load. This is exclusive of driver's wages, which average about \$15 per week, and it does not require nearly the same skill to drive an electric that the gasoline truck requires. For retail stores the light trucks are ideal, and there is every prospect that their use in this service will increase very rapidly. The T. Eaton store has several Waverly trucks in service.

Saskatoon Extensions

The rapid growth of this phenomenal city has necessitated vast improvements and extensions in the Electrical Department. The new power house, which was commenced last year, is now nearing completion, and in the course of the month connection with the main lines of the city will be made and the power turned on. There has been erected a 1,250 h.p. Robb-Armstrong vertical cross-compound engine with a 750 kw. generator, the latter supplied by the Canadian General Electric Company, and a 40 kw. steam-driven direct-connected exciter, the latter and the switchboard also supplied by the Canadian General Electric Company. A contract has recently been awarded to the Allis-Chalmers-Bullock Company for a 2,000 kw. high pressure steam turbine and generator, and two 75 kw. turbine-driven exciters and switchboard complete. A contract has also been let to Messrs. Babcock & Wilcox for five 500 h.p. water tube boilers, mechanical stokers, economizers and induced draft plant.

In the matter of street lighting, too, Saskatoon is going ahead in a manner which in a very short time will enable the city to rank among the best illuminated cities of Canada. Lastyear tungsten boulevard standards were in-

stalled on one of the principal streets, and these have proved so satisfactory that it has been decided to install the same kind of standard on the principal streets and avenues throughout the business section of the city. The type of standard used is the Cutter five-light boulevard post, and an order for 450 of these has been placed. Iron armoured cable is being used in connection with the latter undertaking and is being purchased from the Canadian British Insulated Company, as is also the cable for the fire alarm and police patrol systems which are being installed this year, the contracts for which have been let to the Northern Electric & Manufacturing Company.

Winnipeg Building Line to Gravel Pits

The City of Winnipeg has decided to electrify their gravel pit at Birds Hill, and to that end have started work on the seven-mile, 13,200 volt transmission line from the 66,000 volt sub-station also under construction at Tyndall to the sub-station they are building near the gravel pits. In this sub-station will be installed three 100 kw. 13,200/2,200 volt oil-insulated self-cooled transformers, and a 300 kw. motor-generator set with synchronous motor and 550 volt direct current generator. Power will be carried through an overhead trolley line to the various parts of the gravel pit and will serve a 100 h.p. electric shovel, and an electric locomotive driven by four 75 h.p. 550 volt direct current motors. Contracts for sub-station apparatus have been let to the Canadian Westinghouse Company, and tenders have been called for the locomotive and electric shovel.

Portage la Prairie

In a recent issue the Electrical News gave a brief description of the apparatus installed at Portage la Prairie to fill Crescent Lake. The lake is now filled, and in less than the specified time of one hundred days, and it is full of ice right to the bottom, which ice it is hoped will pull up the weeds that have been so troublesome to the propellers of motor-driven boats. The pump will in future be only operated a few days each month throughout the season to replace water removed by evaporation and soakage. It may also be necessary to provide a small outlet to the lake, as there is a tendency to stagnation. This, of course, would necessitate the more continuous operation of the pump.

The Stephens Brick Company, which have been operating here for a number of years with steam and gas-producer power, are installing a new plant, in a new location, and have made application to the city electrical department for electric power. Individual drive will be used as far as is practical, the motors aggregating about 80 h.p. Variable speed Churton motors made in England are being installed, their first cost being a big consideration. It is the general opinion of those who have used these motors that they are very efficient.

The city is now installing a duplicate generating plant, with a 3-phase, 60 cycle, 2,300 volt, 120 r.p.m., 312 k.v.a. C. G. E. alternator, direct connected to a Goldie & McCulloch cross-compound condensing Corliss engine. They have also decided to change over their present street arc consumption to series tungstens of smaller units more widely distributed. Two or three samples of 7.5 ampere lamps are now being tried out in series with the arcs and they are said to show up very creditably.

Edmonton, Alta.

Plans for the new street car barns are under way and as soon as the ground can be worked construction on the foundations will be started. When completed the new barns will measure approximately 300 ft. x 500 ft. and have a capacity well up to 150 cars, though it is not the intention at the present time to complete more than about half of this

accommodation. The building will be of brick, 27 ft. high. The hot air heating system will be used. In the same building the motor-generator system will be installed. This will include the set now in use and the new set recently placed on order. The new building will be on the site now occupied by the old barns. The city has placed an order for fifteen cars, which will bring the total up to forty-five. The cost of this year's car barn construction will be in the neighborhood of \$60,000.

Power plant extensions include another 2,000 kw. turbo-generator, contract for which has been awarded to the Wilans & Robinson firm, of Rugby, England. Tenders are also called, till April 29, for a 750 kw. railway generator and, till May 6, for a 450 h.p. induction motor.

Recent changes have taken place in the heads of two of the most important electric departments. Supt. J. C. Huffman, of the city power plant, has resigned and is succeeded by Mr. R. H. Parsons. Superintendent Knight, of the street railway system, has also handed in his resignation.

Police Patrol System for Winnipeg

The Siemens Bros. Dynamo Works have just commenced the installation of a complete police patrol system for the city of Winnipeg, consisting of the following equipment for the central office: main controlling switchboard, register table, telephone switchboard, relay table, master clock, battery switchboard and accumulator battery. In addition there are also four sub-station equipments being supplied consisting each of one switchboard with desk. In addition to the above there are 165 patrol boxes for the streets. The same company have also since secured the contract for all aerial cable required in connection with this patrol system.

Fort Frances

An agreement has been reached, which will be submitted to the ratepayers for ratification, between the Ontario and Minnesota Power Company and the town council of Fort Frances. Under the agreement the company will construct a 100 ton paper mill and a 100 ton pulp mill. The surplus power not required for the pulp and paper mills will be available in Fort Frances at \$25 per h.p. or in blocks of 500 h.p. and upwards at \$20, on a three year contract. The town gets 1000 h.p. for all time at \$14 per h.p.

Medicine Hat

The ratepayers on April 12 defeated the by-law granting a franchise to the Medicine Hat Electric Railway Company. According to the plans a line was to have been constructed through the streets of Medicine Hat and extended to Elkwater. It is believed the defeat of the by-law means that a municipal system will be installed.

Moose Jaw

The contract has just been awarded to the Canadian General Electric Company for the supply of a 1,000 kw. turbo-generator for power plant extension.

The Manitoba Government has granted power to the municipality of the town of Minnedosa to guarantee the bonds of the Minnedosa Power Company both as to principal and interest. The amount is to be used in water power development on the Saskatchewan River.

Among recent orders received by the Imperial Wire & Cable Company, Ltd., Montreal, are the following: For the Alberta Government telephone system, cable and wires;

for the British Columbia Telephone Company, a large order for telephone cable; for the city of Edmonton cable and wire for the requirements of the telephone and electric lighting departments.

Mr. H. Doughty, Superintendent of the Municipal Street Railway System of Regina, whose management resulted in the line being operated on a financially paying basis from the very beginning, has severed his connection with the city, his resignation dating from April 1st.

Mr. Horatio A. Foster, who is now with the J. G. White & Company, of New York, is at present in Winnipeg making a complete valuation of the utilities owned and controlled by the Winnipeg Electric Railway Company.

Many New Companies

The Sorrento Water and Power Company Limited has been incorporated with a capital of \$10,000 with head office at Sorrento near Notch Hill, in the County of Yale, B.C.

The Typo Telegraph Company Limited has been incorporated with a capital of \$500,000 to manufacture and deal in telegraph and telephone supplies, equipment, instruments, &c., with head office at Toronto.

Taylor & Young Limited have been incorporated with a capital of \$100,000 to carry on business as electrical and mechanical engineers to supply electricity for heat, light, power, etc., with head office at Vancouver, B.C.

Cantelo Electric Company Limited has been incorporated with a capital stock of \$50,000 to manufacture and deal in all forms of electrical equipment and accessories with head office at Montreal.

The Universal Electric Economy Company Limited has been incorporated with a capital stock of \$50,000 to carry on business as electrical engineers, contractors, dealers in railway, electrical, magnetic and other apparatus, &c., with head office at Montreal.

The Kelvinside Realty Company, Limited, has been incorporated with a capital stock of \$250,000, to carry on business as a land company, to develop and operate water powers, manufacture electric current or other power, etc., with head office at Montreal, Que. The incorporators are G. A. Coughlin, H. H. Scott and A. Charters, all of Montreal.

The Guilbault Company, Limited, has been incorporated with a capital of \$150,000, to carry on business as engineers and general contractors, to construct and operate tramways, wharves, telephone and telegraph lines, electric or power plants, etc., with head office at St. Boniface. The provisional directors are Edouard Guilbault, S. M. Jean and R. E. Lembke, all of St. Boniface.

The South Crosby Rural Telephone Company, Limited, has been incorporated with a capital of \$20,000 to carry on a general telephone business within the townships of South Crosby, Bastard, Burgess South, North Crosby and the village of Newboro, with head office at Elgin, Ont. The provisional directors are Dr. D. A. Coon, J. S. Dargavel, and A. L. Campbell, all of Elgin.

The Peace River Valley Development and Colonization Company, Limited, has been incorporated with a capital stock of \$250,000, to deal in all kinds of timber, lumber, all products of the forest and to construct and operate plants for the generation of electricity, steam or other power, etc., with head office at Winnipeg, Man. The incorporators are J. F. Fisher, W. C. Hamilton, and S. M. Battram, all of Winnipeg.

ELECTRIC RAILWAYS

New Gas Electric Car

In the April issue of the Electrical News a brief description was given of a new car being constructed for the Canadian Northern Railway to operate on a spur of the main line between Quebec and Lake St. Joseph. During the month of April the first of these cars was received in Toronto and tried out over the lines of the Toronto & York Radial Railway Company and the Toronto Eastern Company, operating as far as Trenton. During these trials the car attained as high as forty-five miles an hour and showed itself capable of excellent control. This car has been supplied to the C. N. R. through the Canadian General Electric Company.

New Centre-Entrance Low-Step Cars

What must be considered a most radical departure from the accepted traditions of street railway practices is the new centre-entrance low-step car just completed by the New York Railway Company, and described in a current issue of the Electric Railway Journal. Primarily this car has been developed to give the travelling public the maximum of comfort and safety. It is believed the new arrangements will absolutely stop the boarding and alighting accidents, as well as provide unusual conveniences to passengers in getting on and off the cars.

As shown in the line cut, Fig. 1, the car is 40 ft. 8 in. long over all with an extreme width of 8 ft. 3 in. The trucks are located on 29 ft. centres, and it is the location of these at the extreme end of the car which makes the low floor possible, as described later. The dotted line in the side elevation shown, Fig. 1, represents the floor of the car. It will be seen that this floor rises only slightly above the axles of the wheels, the space above the wheels themselves being utilized for seats as shown in the bird's-eye view in Fig. 2. The seating capacity of the car is 51, and there is standing room for 30 additional passengers, as shown. At the extreme ends of the car are the cabs for the motorman. These are separated from the inside of the

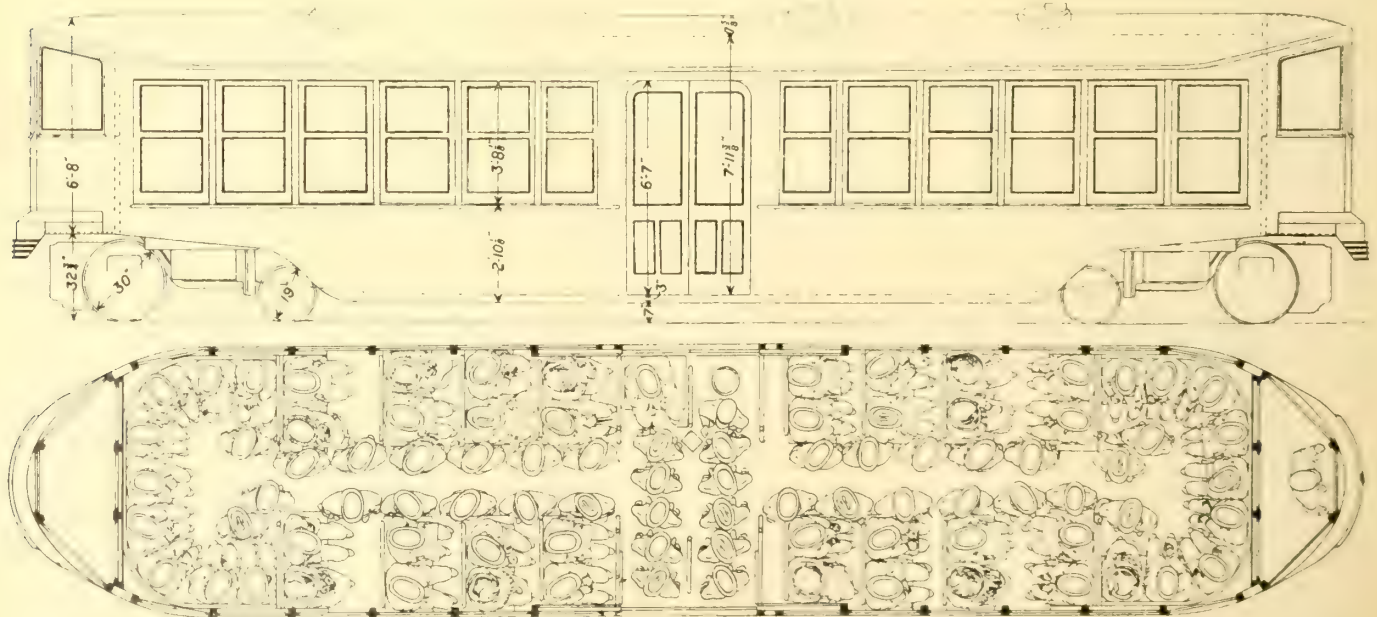
car by bulk heads with large windows. Access to this compartment is through the front end door.

The only exit or entrance for the public is through the centre door. This door is controlled in a strictly automatic manner so that it will be impossible for the car to start until the door is closed tight. It will also be impossible to open this door until the car stops. When the door is closed there is no step or other extension on which or to which the passenger can possibly cling. The automatic device which closes the door also prevents the possibility of passengers getting part of their body or clothes caught in the door, for the reason that the pressure is relieved as soon as any object opposes the movement of the door, and this pressure is automatically re-applied as soon as the object is removed. The fact that the motorman is unable to start the car until this door is shut tight therefore insures that the car cannot operate until the passengers are absolutely free from the doorway.

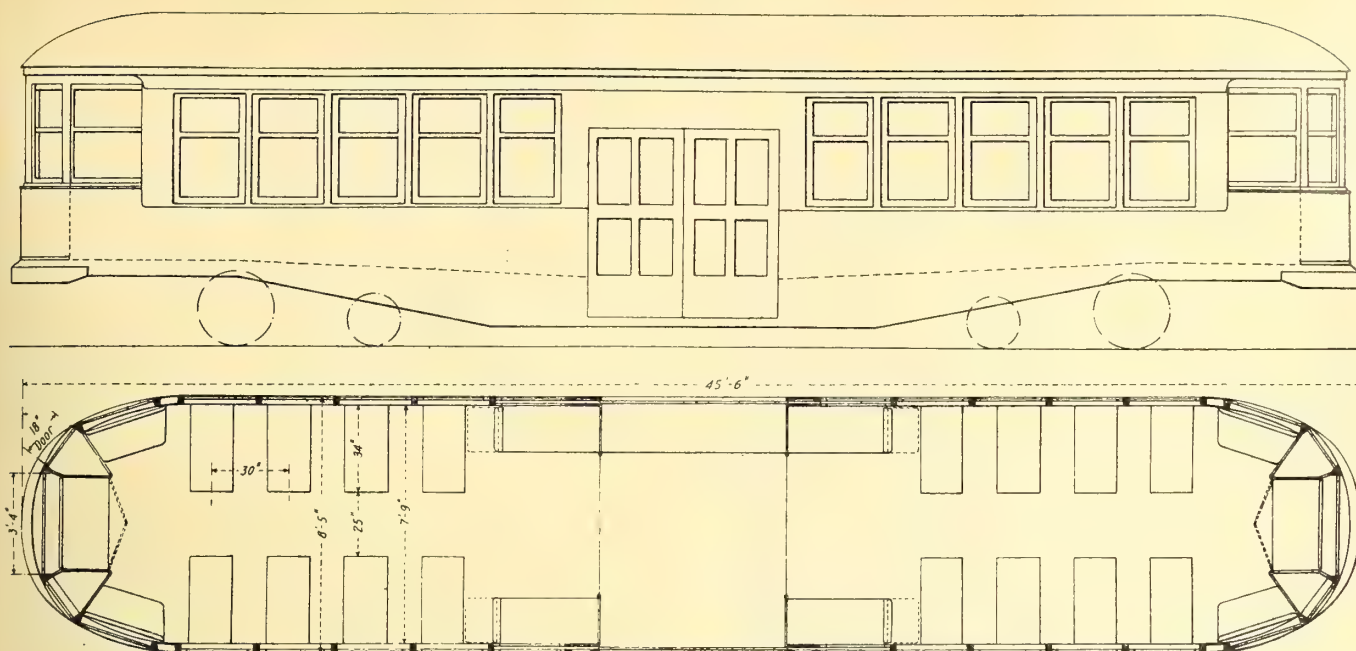
The height of the car from track to sill is only 7 in., and the top of the step is only 10 in. from the ground. The door opening is 3 ft. 10 in. wide and 6 ft. 7 in. high. The length of the cross-seats is 36½ in. The aisle width is 26 in.

It will be seen from the second diagram, Fig. 2, that the entire centre portion of the car over a width of 4 ft. is devoted to receiving and unloading passengers. The conductor, as shown in this view, occupies one side of this space opposite to the doorway at which passengers are entering. The conductor is provided with a high stool to enable him to look over the heads of the passengers to see that the doorway is cleared. He will have no need to leave his seat as his sole duty will be to make change and open and close the centre door opposite to him.

Another type of car designed for experimental purposes and very similar to the above is being designed by the Brooklyn Rapid Transit System. The plan of this car is shown in Figs. 3 and 4. The most striking feature of the design is that the entrance, which is also by a centre door only, is only 14 inches above the rails. As the passenger turns to right or left towards the seating compartment of



Figs. 1 and 2. Sectional and Bird's Eye view low-step center-entrance New York cars



Figs. 3 and 4. Cross Sectional designs of low-step centre-entrance Brooklyn cars

the car there is another rise of 10 inches with a further gradual inclination of 6 inches in about $11\frac{1}{2}$ feet. This raises the floor at the extreme ends of the car just sufficient to clear the wheels. It will be seen that by using this plan no changes are necessary in the design of the bolsters or the placing of the trucks, the innovations being confined entirely to the body of the car.

The arrangement of the seats and of the motorman's cab is shown in Fig. 4. The motorman's door leading to the street is placed at one side instead of in the extreme end as in the New York car. An important feature in connection with these end compartments is that they are collapsible, being furnished with folding seats which may be used at the end which, for the time being, is not in service. The seating capacity is 58 passengers when making use of the stationary seats and the folding seats at one end.

New B. C. E. R. Equipment

The B. C. E. R. Co. recently placed an order for additional rolling stock for its lines with the St. Louis Car Company, of St. Louis, Mo., involving an expenditure of \$200,000, covering the construction of twenty-two passenger cars for interurban lines, and two baggage cars for use on the larger interurban lines. It is expected the new cars will be complete and ready for service by July 1st of this year. The passenger cars will be 45 ft. in length, with a seating capacity for 62 persons, as well as ample aisle space for use during the periods of traffic congestion. They will be of partial steel frame construction and embody the latest improvements for strength and convenience which have been brought forward by car designers of the continent. Sanitary principles play an important part in the plans for the cars. The roof will be of the arch type, similar to the latest cars placed on city lines, the claim of the designer that this form of roof affords best ventilation, having been verified in practice. The seats of the new cars will also be similar to those used in the "300" type of cars recently purchased from the Brill Company, as many comments have been made by the Vancouver public relative to this type affording great comfort. They also combine sanitary advantages, as cars fitted with this type of seating may be thoroughly cleaned with a hose. The two baggage cars which will form part of the order will be similar to the class now in use on the Fraser Valley division of the

company's line. The electrical equipment for the new cars will consist of four 75 horse power motors for each car, fitting them for rapid service.

L. & L. E. Co. Erecting Modern Shops

The London & Lake Erie Transportation Company, which operates an electric service between London, St. Thomas and Port Stanley in conjunction with the Ontario and Ohio Navigation Company, connecting Port Stanley with Cleveland, are erecting new shops this summer in St. Thomas. The building will be one storey, brick, 210 feet by 91 feet, with master mechanic's room, stock room, armature winding room, machine shop, blacksmith and carpenter shops on one side, and inspector's room, conductors' room, linemen's quarters, boiler room, sand drier room, coal room and boiler house on the other side. The building will be divided by a wall running the full length and up to the roof, and each half contains two tracks accommodating four cars on each track,—sixteen in all. Pits will extend under each track from the front half way back and the full length of the building under one track. On the west side at the rear will be a wash room to accommodate one car at a time.

This building will replace the oldest hotel in St. Thomas, the Hutchinson House, which is said to have been standing for over sixty years.

This company has also just completed an office building and an addition to their freight house in London; a new sub-station and freight house in St. Thomas and added four fifty-foot passenger cars and a baggage car to their rolling stock. Alterations are now being made in their different sub-stations preparatory to taking power from the Hydro-electric Commission of Ontario. Recently also a twelve acre gravel pit has been purchased which the company will commence working at once with a view to putting their tracks in first class condition during the early spring.

The Winnipeg Rural Lines

At the 1911 session of the Manitoba Legislature, bills were passed incorporating the Manitoba Power Company, Rural Railways, Winnipeg River Railway, and Winnipeg North Eastern. Very broad powers were given in several of these bills, notably those incorporating the Manitoba

Power Company and the Rural Railways. At the recent session of Parliament which was prorogued on April 6th, new bills were presented which, if passed, would have cancelled the charters already issued. The city officials through their solicitors at once entered a vigorous protest against any and all points in the new bills, blocking legislation in the Private Bills Committee for weeks, and bringing out no definite objections to the bills, except on general principles. These bills conceded more powers to the city than the charters they were to replace, and expressly provided that the purchase by the company of the Winnipeg Electric Railway Company would in no way revive the powers, franchises, good will, privileges, etc., of the companies taken over, thereby losing to the Manitoba Power Company the privileges granted under the Privy Council decision. The amendments to the Rural Railway Act clause 23 were equally liberal to the city, providing for the transfer to the city at the end of thirty years all lines within the then city limits at a physical valuation plus ten per cent., and for the payment of a percentage of earnings and car tax the same as now paid by the Winnipeg Electric Railway Company. So far as can be seen from a careful perusal of the bills, the city had ample protection. The promoters were apparently willing and ready to treat with the city on any points under dispute, and wanted only those privileges that would insure a reasonable return on the capital invested. When it is also taken into consideration that the rural railways will probably serve more than any other one thing to develop the country surrounding Winnipeg, and will also cheapen the cost of living by the encouragement of dairy and other mixed farming, it is difficult to understand the opposition to these bills, except that they were introduced at a time when the city was smarting from the adverse decision rendered by the Privy Council, and wanted nothing further to do with large power corporations. After days of debate, the city representatives were asked by Premier Roblin to submit their objections condensed to one page. These were carefully considered by the private bills committee and the interested parties and an agreement satisfactory to the city was made. This was to the effect that the city would not object to the Rural Railways bill, providing the Manitoba Power Bill was withdrawn, and that assurance would be given the city that the suit which the Winnipeg Electric Railway Company has against the city for pole trespass be withdrawn. As this assurance could not be given at the time, an enabling act was passed, operative on signature by Gov. General in Council, enabling the company to take over properties of the Winnipeg Electric Railway Company in the city.

The bills as they now stand are as follows:

The Rural Railways.—Capitalization \$10,000,000, with rights to increase from time to time. The lines will radiate from Winnipeg in all directions, and there will be a belt line encircling the city, with stub lines to city terminals. This company proposes to take over the Winnipeg, Selkirk and Lake Winnipeg Railway, and the Suburban Rapid Transit, both subsidiaries of the Winnipeg Electric Railway. They have the right to carry on a general business of electric light, heat, power and railways, using electricity or other power. The above powers are subject to franchise approved by electorate of municipalities.

The Brandon Electric Bill,—which was enacted at the 1911 session, grants powers for a general railway, light, heat and power business in Brandon and district, and would be similar to the Rural Railways radiating from Winnipeg and would ultimately connect with them. The above is, as with other charters, subject to the approval of municipalities concerned, and in case no agreement is reached appeal to the Public Utilities Commissioner may be taken and his decision is final in the matter.

The Winnipeg River Railway,—will be a construction line twelve miles long from Lac du Bonnet to the proposed power site at Grand Bonnet Falls.

The Winnipeg North Eastern Railway—holds a general railway charter for a line operated by steam, electricity, or other means from a point outside Winnipeg running northeast to the east side of Lake Winnipeg, and thence north along the east shore of the lake to connect with the government line to Hudson Bay or to Port Nelson.

The Manitoba Power Company—retains the powers granted last year with the addition of the expropriation clause of the Manitoba Railway Act.

Permission was granted to the town of Minnedosa to guarantee bonds for an electric light company in that town to the extent of \$40,000, this to be subject to a by-law. The town would have a first lien on the property.

Brandon Street Railway

The City Council of Brandon has approved a draft contract with J. D. McGregor, of Brandon, for the building of a street railway system in that city. By the terms of the contract, five miles of track must be in operation by December 1, 1912. A by-law will be prepared giving to Mr. McGregor an exclusive franchise for thirty years and this will be submitted to the people June 15th. All indications are that the by-law will be passed. It is stated by Mr. McGregor that the company, which is heavily backed by English capital, will also negotiate for the purchase of the Brandon Electric Light Company.

Time Allowance Extended

The annual meeting of the share-holders of the Niagara Falls, Welland and Dunnville Electric Railway Company was held recently, and the following officers elected: T. R. Lalor, Dunnville, President; Dr. Boulter, Niagara Falls, Vice-President; F. E. Misner, Marshville, Secretary; G. H. Burger, Welland, Treasurer; G. H. Pettit, Welland, was appointed solicitor. Mr. Gardiner, Niagara Falls, is Consulting Engineer. The time allowed for the completion of the road has been extended and it is hoped that work on construction will commence during the present year.

Oshawa Railway Buying New Equipment

The fire which occurred at the car barns of the Oshawa Railway Company destroyed a quantity of valuable rolling stock. It is likely that four new standard cars of semi-convertible type, 40 ft. in length, will be required to replace those destroyed by fire. The company will also install a sweeper, work car and a shunter. Arrangements are already under way to erect a new car barn 200 feet long which will be fireproof and fitted up with all modern conveniences. Mr. D. A. Valteau is superintendent of the Oshawa Railway Company.

Mr. H. E. Grant, who was formerly connected with the B. C. E. R. Co., in Vancouver, in the capacity of sales agent, recently accepted the position of manager of the San Francisco office of The Holophane Company.

Mr. T. H. Mawson, a prominent English landscape architect, at present in Vancouver, has been engaged by the B. C. E. R. Co. to prepare plans for the layout of the various parks and residential resorts which are planned on Vancouver Island in connection with the Saanich lines of the Company.

CANADIAN TELEPHONES

An Ideal Heating Equipment for a Telephone Exchange

Last summer the city of Fort William had under consideration the installation of a new heating plant for the municipal telephone exchange, and the manager of the city utilities decided to investigate the possibilities of electric heat. The city is in a good position to consider such a plan, as it buys current on a peak basis and the extent of the peak is only about two hours. At first it was figured that a hot water system would be necessary also, but it was determined that the cost of the installation and the losses entailed by the double conversion would be considerable.

At that time the problem was put before the Simplex Electric Heating Company, and an examination of the building showed that, in all probability, a shut-down of not more than two hours in a day would not entail a temperature drop in the interior of more than ten degrees. As this was considered allowable a tender and specifications were secured and at the same time, a tender for a coal fuel hot water plant was obtained. The latter figure, not including the boiler, was found to be some \$300 higher than the price of the electric radiators.

The building itself is a two-storey and brick basement, with about thirty windows. The walls are furred and plas-

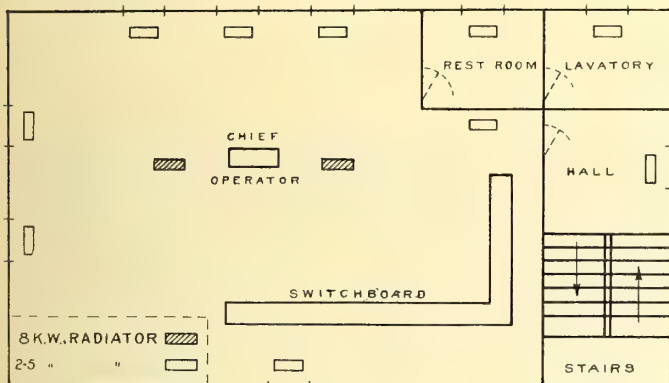
mounted in a ventilated cast iron frame. Three of these may be seen in the accompanying photograph under the windows. Both the 6 and 8 kw. radiators were of the grid type, mounted in cast iron ventilated frames and having controlling switches mounted on the frame. All radiators



One corner of the Fort William Exchange

were finished in aluminium paint. It will be seen that the installation was a very flexible one and, all the radiators being easily portable, gave opportunity for any changes that might be required in the future.

It was not until January that an opportunity arrived to give the installation a severe test. Then a long spell of



Showing location of radiators in Exchange

tered, but it is in a rather exposed position and not of particularly good construction. No double windows were to be used. The interior dimensions are 33 ft. by 60 ft. and the stud 10 ft., making a total of about 39,600 cubic feet, exclusive of the basement, which is not heated. The lower floor is given over to the apparatus and a work shop. The upper floor contains the switchboard, and a toilet and rest room for the operators. A temperature of 65 degrees F. was required downstairs and 70 degrees F. upstairs, with 40 degrees below zero outside.

The installation as finally made was 73 kw. divided as follows.

First floor hall, one $2\frac{1}{2}$ kw. radiator.

First floor, two 6 kw. radiators spaced $\frac{1}{3}$ and $\frac{2}{3}$ of the way down the room and seven $2\frac{1}{2}$ kw. radiators placed around the room under the windows.

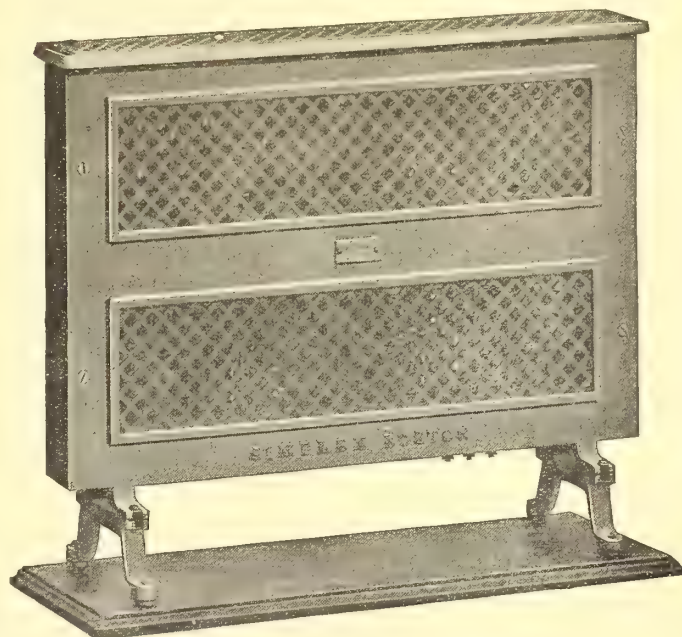
Second floor hall, one $2\frac{1}{2}$ kw. radiator.

Switchboard room, two 8 kw. radiators spaced as in room below; seven $2\frac{1}{2}$ kw. radiators placed under the windows.

Rest room, one $2\frac{1}{2}$ kw. radiator.

Toilet, one $2\frac{1}{2}$ kw. radiator.

The $2\frac{1}{2}$ kw. radiators used were of the coil spring type

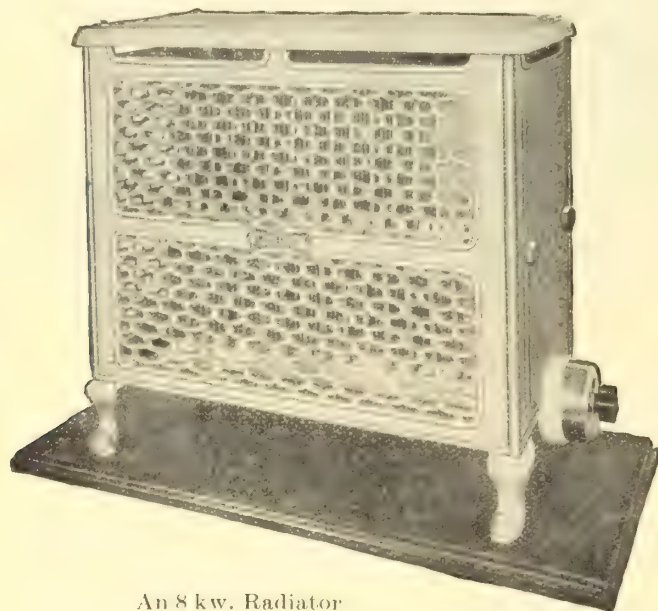


One of the $2\frac{1}{2}$ kw. Radiators

cold weather, with an average temperature of 40 degrees below zero occurred. At all times the radiators were able to maintain from 72 to 73 degrees inside with 40 below outside, even when one of the windows was partly open to help ventilation, and this, too, with some of the radia-

tors cut out, so that the actual peak of the radiator consumption was 54 kw.

While not particularly notable for its large kilowatt capacity, the installation presents some rather interesting features. In the first place, it was put in without auxiliary apparatus of any kind, sole reliance for heat being placed on the electricity. Secondly, the building was used twenty-four hours of the day and seven days a week, making an almost constant load. Third, the off-peak element could there be introduced largely because of the geographical position of Fort William, it being almost at the western limit of eastern time, and the lighting peak comes at a time when practically all the power load was over for the day. Perhaps the most notable feature is the small number of watts per cubic foot of space to be heated. Commonly 2 watts per cubic ft. is considered the minimum requirement for 70 degrees temperature inside with zero weather outside, but here we have an installation with a maximum capacity of $1\frac{3}{4}$ watts per cubic foot with 40 degrees be-



An 8 kw. Radiator

low zero outside temperature. This result is due largely to the judicious distribution of the heat and location of the radiators, to take advantage of all natural ventilation. Under these circumstances much better results may be obtained than by merely placing radiators of any convenient capacity in what are apparently the most convenient, so to speak, geographical locations. Of course, all these points were to the advantage of electric heat, but equally favorable conditions might be found in other places, and similar opportunities for the use of off-peak current will often arise in many central stations.

Credit for the idea of this heating plant is due to A. L. Farquharson, Manager of Public Utilities for the city of Fort William, and the installation itself was designed and the radiators furnished by the Simplex Electric Heating Company, Canadian branch at Belleville, Ontario, of which Mr. MacAllister Moore is manager.

Vancouver Telephone Rates

The increased telephone rates in Vancouver came into effect on April 1st. The rate for unlimited service was changed from \$4 a month to \$5. At the same time the British Columbia Telephone Company is inaugurating a measured service of \$3 for the first one hundred calls, plus two cents for each additional call over the first one hundred. Judging by the orders that have been received to date, it is said about a quarter of the total number of subscribers will use the measured system.

Extend to Penticton

In response to numerous petitions, the government telegraph service in the Okanagan Lake district, British Columbia, will soon be extended through the valley to Penticton, with offices at all the more important points. At the present time the service ends at Vernon. An additional telephone wire connecting Vernon, Kelowna, Summerland, and Penticton, will also be strung. This will relieve the present congestion of telephone and telegraph business in that district.

New Telephone Companies

The following telephone companies have recently been incorporated in the province of Saskatchewan:—The Mount Pisgah Rural Telephone Company, The Inglewood Rural Telephone Company, The Fairlight Rural Telephone Company, The Prospect Rural Telephone Company, The Broadalbane Rural Telephone Company, The Dewdney Rural Telephone Company, The Strassburg Rural Telephone Company, and the Kindersby Rural Telephone Company. The Govan Rural Telephone Company has increased its capital.

Miscellaneous

The Bell Telephone Company has been granted an exclusive five-year franchise in Windsor, Ont., for which they are to pay \$1,500 a year and furnish the city with a number of free telephones.

The Bell Telephone Company has agreed to the request of the City of Ottawa for an annual payment of \$12,000 for an exclusive franchise during another five year period. Payment in the past has been at the rate of \$5,000 per annum.

The Bell Telephone Company has been granted an extension of their franchise in St. Thomas, Ont., for the next five years for which they pay \$500 per year and supply a number of free telephones for the city's use. In certain sections the wires will also be placed underground.

It is understood that the city of Lethbridge will be made the centre of the telephone district of Southern Alberta. During the year the Exchange building there will be extended, the equipment will be increased to a 1,500 line capacity and toll and rural lines will be built in the neighborhood. It is said that \$20,000 will be expended in the city of Lethbridge.

Arc Lighting Extensions

That the arc light is not yet a thing of the past is evidenced by a recent announcement that the city of Chicago has closed a contract for 10,000 arc lamps for street lighting in what is known as the Sanitary District. The specifications provide that the lamps must be of the flame type and adapted for operation on a current of 10 amp., 60 cycles frequency, 60 volts, and a consumption of 460 watts at the arc. The electrical efficiency of the lamp must equal 90 per cent., and they must operate on a power factor of not less than 78 per cent. With yellow-light electrodes, the mean, lower hemispherical candle power on clear globes will be 22,000, and at 45 degrees below horizontal with clear globes the candle power is to be 25,000. The lamp is guaranteed to operate from 90 to 100 hours on one trim. The height of suspension is 20 feet, although an endeavor is being made to have this raised to 30 feet. The price of each lamp complete is \$31.

Questions and Answers

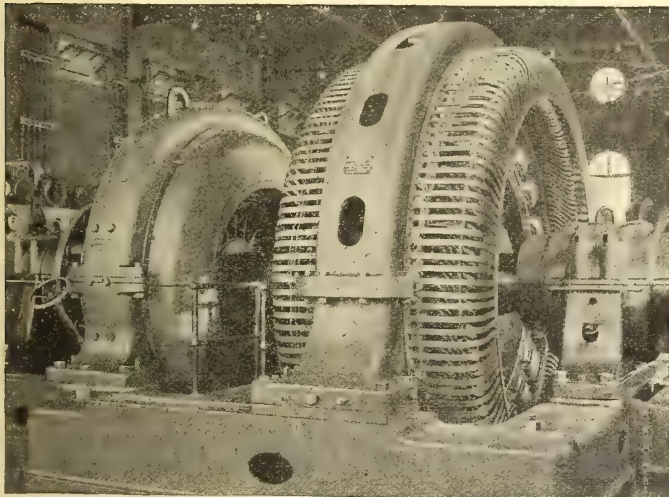
GENERAL RULES TO BE OBSERVED BY CORRESPONDENTS

1. All enquiries will be answered in the order received, unless special circumstances warrant other action.
2. Questions to be answered in any specified issue, should be in our hands by the close of the month preceding publication.
3. Questions should be confined to subjects of general interest. Those pertaining to the relative value of different makes of apparatus, or which for intelligent treatment, should be placed in the hands of a consulting engineer, cannot be considered in this department.
4. To avoid trouble and unnecessary delay, correspondents should state their questions clearly, so that there can be no possible doubt as to the information required.
5. In all cases the names of our correspondents will be treated confidentially.

Power-factor Correction

Q.—What is meant by saying synchronous motors of unnecessarily large capacity are sometimes installed for power-factor correction? How does the synchronous motor correct the power factor and to what extent can this correction be obtained by using a larger motor than is necessary?

A.—The power factor on a system is often unsatisfactory because the current lags behind the e.m.f. due to self-induction in the electric equipment installed. A synchronous motor overcomes this difficulty in that by its capacity it produces a leading current which off-sets the lagging effect of the other apparatus. For example, at the present time the water pumping plant in a Western Ontario town requires a 150 h.p. motor which would normally be of the induction type. In order to have a means of correcting the



power factor, however, the Commission suggest that a 250 h.p. synchronous motor be installed to be used for power factor correction. The fact that the extra cost is being paid by the Commission indicates the value they place on this type of apparatus. A similar case has just come to the writer's notice where a machine consisting of a 1,500 kw. Westinghouse synchronous motor-generator is composed of a generator wound for 550 volts d.c. and of the above rated capacity, driven by a motor wound for 10,000 volts, 60 cycles with a rating of 2,340 kv.a. being specially designed for operation at 70 per cent. power factor for correction purposes. The size of the motor with respect to the generator is shown in the illustration herewith. At the present time the load on the system supplying the motor generator is of such a nature as to make advisable the operation of the set at only 100 per cent. or at a small leading factor-power. In the event, however, of a change in the character of the

load there is available for power-factor correction purposes in addition to the corrective effect of the power component of the d.c. generator, 1,635 kv.a. of leading wattless current.

Electrolytic Rectifiers

Q.—In your March issue you describe the mercury arc type of rectifier for transforming alternating to direct-current. This, however, is too expensive an apparatus for a small operator with only a cell or two to charge. Is there not some simpler form of rectifier and some cheaper form that one who is more or less of an amateur and requires it for amateur purposes, could use?

A.—Yes, there is a simpler, cheaper form of rectifier but it is also much less efficient. Perhaps its simplicity of construction will commend it to you. It is known as the electrolytic rectifier and depends for its operation upon the fact that in an electric cell containing an aluminum plate and (say) a lead plate, no voltage of less than about 150 can be made to pass from the aluminum to the lead plate, although any lower voltage will produce a current in the opposite direction.

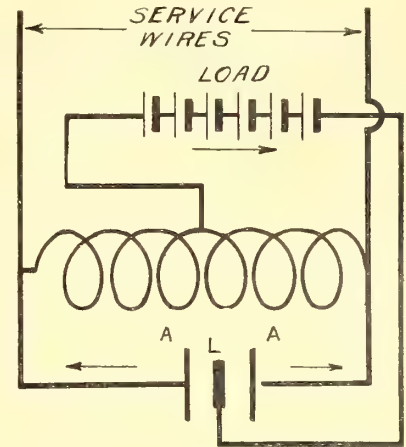


Fig. 1

There are two simple forms of this electrolytic rectifier, as shown in the two diagrams herewith. The first requires only one aluminum cell and a reactance coil, as shown. The cell contains two aluminum plates and one lead plate. As indicated by the arrows, the oscillatory current passes from the lead plate right or left to the aluminum, passing always in the same direction through the d.c. lead shown above. This type of cell is probably not more than fifty per cent. efficient.

Another form is shown in Fig. 2 which requires four aluminum lead cells arranged as shown. The current passes from the lead to the aluminum in one cell through the load and from the lead to aluminum through the cell at the opposite corner, shown in the diagram. Thus a continuous current is always passing, as shown and may be used for charging cells or doing other direct-current work. It is probable that this type is, in general, somewhat more efficient than that shown in Fig. 1, but it is as you see, slightly more complicated in its construction.

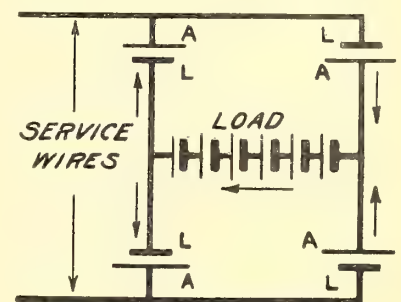


Fig. 2

Much of the efficiency depends on the size of the aluminum cells, the electrolyte being kept at as low a temperature as possible, the efficiency depreciating rapidly with rise in temperature. The aluminum and lead plates also require to be of quite ample dimensions. The electrolyte used in these cells may be a neutral solution of ammonium phosphate or sodium phosphate in water.

Industrial Progress and Trade Notes

Trade Publications

Condulet Talk.—Series 2, No. 8, issued by The Canadian General Electric Company, Toronto.

Modern Illumination.—Catalogue issued by the H. W. Johns-Manville Company, descriptive of Frink designs for the types of illumination best suited to insurance companies and banks; well illustrated.

Underground Conduit Construction.—1912 catalogue on underground conduit construction, issued by The American Conduit Company, of New York. Also a bulletin on ornamental street lighting. This company makes a specialty of bituminized fibre conduit for its underground work.

Small Motors.—A monthly publication issued by the industrial and power department of the Westinghouse Electrical & Manufacturing Company. This month's edition is devoted to electric motor vehicles, and contains valuable information with reference to the operation of these vehicles and their production of revenue for the central station.

"Train Lighting Lamps" is the title of a bulletin issued March 15th, 1912, by the Engineering Department of the National Electric Lamp Association which is sustained by certain works of the General Electric Company, covering the description, performance and economy of Mazda and Gem lamps in train lighting service. Copies of this bulletin may be secured from the Engineering Department above mentioned.

Current Meters.—A bulletin issued by the W. & L. E. Gurley, of Troy, N. Y., describing and illustrating the Gurley meter for the accurate measurement of the velocity of water in streams. The same company has also issued a second bulletin called Water Stage Register, describing their equipment for determining accurately the varying heights of water in streams and registering them continuously over a stated period of time.

"Noark" Perfection Devices.—Catalogue No. 406, issued by the H. W. Johns-Manville Company, of New York, describing "Noark" enclosed fuse protection devices. The catalogue contains first a description of the more important improvements that have been made during the past few years in this type of protective apparatus, and is followed by minute details of the latest designs. This is one of the most comprehensive and attractive catalogues we have seen, containing over three hundred pages of splendidly illustrated matter, well and attractively bound in stiff covers.

Westinghouse Publications.—The Westinghouse Electric and Manufacturing Company have issued the following new publications: Motors for crane and hoist service; Leaflet No. 2409, describing self-starting synchronous motors; Multiple unit trains and H L control; Folder No. 4049, describing type F. carbon circuit-breakers; Type C A alternating current motors; Leaflet No. 2446, describing electrically operated brakes; Leaflet No. 2449, describing hand-operated controllers; Leaflet No. 2447, describing electrically operated brakes; Leaflet No. 2383, describing a.c. steel mill motors; Circular No. 1088, describing three-wire direct current generators.

Douglas-Milligan Will Handle Escher-Wyss Equipment

The agency business formerly operated under the name of Eadie-Douglas Limited with head office at 12 University street, Montreal, has been reorganized and the name changed to Douglas-Milligan Limited. Mr. H. C. Eadie has withdrawn absolutely from the business and the present organization consists of H. P. Douglas, President; G. M. Milligan, Vice-President, and E. M. Watson, Secretary-Treasurer. The Toronto branch office is now under the management of Mr. W. F. Gouinlock with offices in the Confederation Life Building, and the company is represented by live agents in the leading cities throughout Canada.

This company represents in the building and mechanical lines some of the best known concerns, the principal ones being the following:—B. F. Sturtevant Co., Boston, fans, blowers, heating and ventilating contractors, engines, generators, motors, &c.; Keystone Fireproofing Co., New York city, manufacturers of Keystone gypsum partition blocks and wall furring; Leeds Fireclay Co., Leeds, England, ornamental exterior and interior terra cotta, enamel bricks, &c.; McFarlane-Douglas, Ottawa, sheet steel and kalamined fire-proof doors, kalamined and metal covered windows, fire doors, &c.; Terrano jointless flooring; Alphons Custodis Chimney Construction Company; Edward Darby & Sons Co. Inc., Philadelphia; Avery Scale Co. of North Milwaukee; Esco preservative steel paint; Preservo waterproofing for canvas, duck, &c.; Ceresit waterproofing; Reliance ball bearing door hangers.

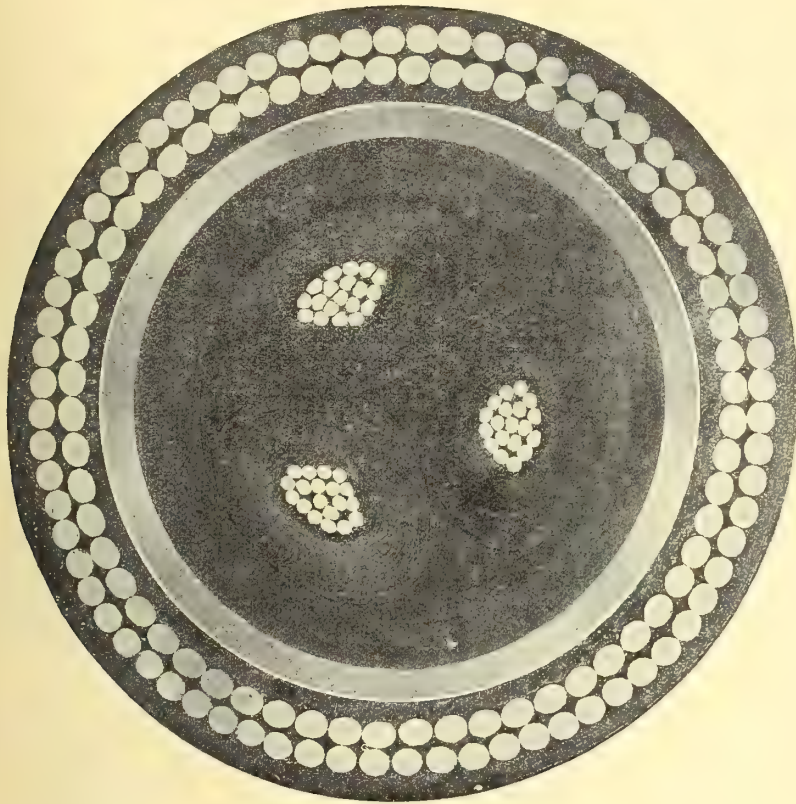
Douglas-Milligan will also specialize on leading mechanical lines as follows:—De La Vergne Machine Co., manufacturers of artificial ice making machinery and specialists in the design and equipment of artificial ice rinks and ice plants; The Jewett Refrigerator Company, of Buffalo; Escher Wyss & Company, Zurich, Switzerland (Eastern Canada only), manufacturers of water wheels, turbine pumps, etc.; Richardson-Phenix Company, New York City, oiling and lubricating devices and systems; Roberts Filter Manufacturing Co., Philadelphia, specialists in filters and water purifying systems; Nelson Valves; U. S. Gauges; Direct (Sweet's) Separators; Metropolitan Injectors; Blackburn-Smith Feed Water Filters, &c.

Re-organization of Allis-Chalmers Co.

Receivers were recently appointed for the Allis-Chalmers Company, of Milwaukee, these formal legal proceedings being necessary to complete the re-organization of the company. The plan which is being adopted has been under consideration for some time and it is understood is completely satisfactory to all concerned. Under the new arrangement the bond holders and the preferred and common stock holders agree to give up their securities and accept instead preferred and common stock in the new company. This eliminates most of the bonds, thus relieving the company from a very heavy burden of fixed charges. New capital amounting to over \$5,000,000 has been realized by assessments on the outstanding preferred and common stock of the old company. As a result the company will be placed in a strong position and be capable of taking full advantage of their fine plant at Milwaukee. It is claimed also that the Allis-Chalmers-Bullock, Limited, the Canadian branch, although operated as a separate organization, will benefit by the financial re-arrangement of the United States company.

25,000 Volt Cable for Kaministiquia Power Company

The cut shown herewith is an exact size reproduction of a 25,000 volt submarine cable being supplied by the Canadian British Insulated Company, for the Kaministiquia Power Company, to the specifications of R. S. Kelsch, consulting engineer. Each of the three conductors is composed



of 19 strands of .075 inches diameter, equal to No. 1/0 B & S gauge and having a conductivity equal to 100 per cent. Matthiessen's standard. These are insulated with impregnated paper, each strip of which taken lengthwise must have a guaranteed breaking stress of not less than 9,000 pounds per square inch sectional area after the paper is impregnated with the insulating compound. The thickness of each strip of paper must not exceed three mils and the insulating compound used has been specially designed with a two-fold object; first, to remain sufficiently flexible at all temperatures to which it is likely to be subjected, and second, to be unaffected by any ozone which may be formed during the working of the cable under a 25,000 volt alternating current. The lead sheath which surrounds the paper insulation is specified to be 99.8 per cent. pure lead and is put on the cable under hydraulic pressure at a temperature not exceeding 600 degrees F. The armouring consists of compound jute over the lead, then two layers of steel wires laid in reverse directions with a further layer of impregnated jute thereon. The tests called for on this cable are as follows,—at the factory 75,000 volts alternating current for a period of 5 minutes; when installed complete, 50,000 volts for 5 minutes. The diameter over the lead is 3.25 inches and the diameter over all 4.15 inches. The weight per foot is 22 pounds.

423. Tungsten wire lamps.—A London firm manufacturing annealed tungsten wire lamps for steamships, piers, quays, cotton mills, etc., desires to get into touch with Canadian importers.

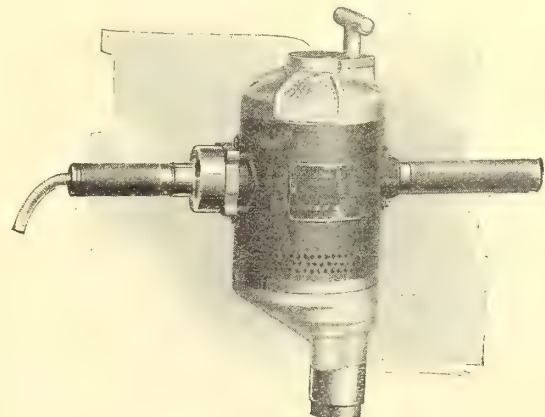
Mercury Converter for Street Railway Work

In answer to a subscriber a description was recently given of the operation of an ordinary mercury vapor converter for such work as charging storage batteries or lighting arc lamps. In this short article it was mentioned that the mercury converter had been tried out on street railway work, but that for the most part it was found to make too heavy a demand on the apparatus. Reports have now been received that Dr. Peter Cooper Hewitt, who invented this type of lamp, has been successful in developing a mercury vapor converter capable of supplying energy sufficient to operate street railway cars. The fundamental principle of the apparatus differs little from the earlier type, but the construction features have been altered to overcome the output limitations of the former type. With this latest equipment an output of 700 amp. has already been reached as compared with 50 with the old type.

In street railway work it has been considered most satisfactory to use d.c. current. This is especially true in Canada, where, without exception, all of our systems operate on d.c. somewhere between 500 and 600 volts. On the other hand, it is often necessary to transmit power to the railroad from a considerable distance, and this is done most economically with alternating high voltage current. Combined with a transformer, a rectifier of this type, with a high efficiency, simplicity of operation, and requiring little attention, seems to promise the best solution of many of the troubles of operation met by the smaller and more isolated street railway systems.

Motor Operated Drills

The Van Dorn & Dutton Company, of Cleveland, through their Canadian agent, R. E. T. Pringle, Windsor, Ont., have placed on the market an improved line of hard service, portable, electrically-operated drills and reamers. The accompanying cut shows one of these drills operating with a universal motor, i.e., one that will operate on d.c. or a.c. current equally well. This particular motor is de-



Drill operating with universal motor

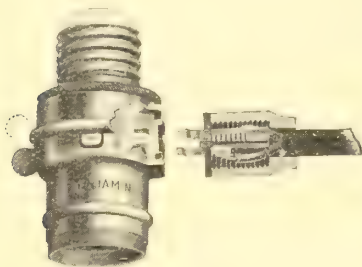
signed for either 110 volts d.c. or for 110 volts a.c. at any frequency from 20 to 150. The motor is series wound, and mounted on standard ball bearings.

The machine is built in three sizes; a quarter inch capacity in 60 per cent. carbon steel, or three-eighth inch in hardwood with a reaming capacity of three-sixteenth inch

and with the low weight of six and a half pounds. The motor in this machine runs at 1,600 r.p.m. and is equipped with Hess Bright annular and thrust bearings. The other two sizes are three-eighth inch and one-half inch. Larger sizes than these are made, but are not supplied with the universal motor. It is calculated that an air drill of $1\frac{1}{4}$ inches capacity, i.e., a standard drill with four pistons, takes about ten boiler h.p. to run it, while the electric drill of the same size only requires from two to two and a half boiler h.p. This represents a large saving in power. With the electric tool also there is practically no vibration and no oil or dirt to contend with. This means much more efficient work on the part of the operator.

New Current Tap

Among the many recent specialties put on the market by the Benjamin Electric Manufacturing Co. few are more unique and serviceable than their No. 96 Current Tap. This device is of a separable nature and is so constructed



as to have individual control of both the lamp and the extension. It has a rotating sleeve whereby it may be attached and fixed in a socket or outlet in any desired position for leading out the cord, without turning the device. A bead on the

shell permits the transfer of any standard shadeholder. The lamp is controlled by the lever switch and the extension may be plugged in or pulled out as service requires, the current connections for the extension plug always being positive. This Current Tap is also useful where it is necessary to retain a lamp and yet provide means for attaching a fan, portable lamp, flat iron, sewing machine motor, etc. Standard finish is polished brass but it can be furnished in any special finish to match fixtures.

Canadian Westinghouse Annual

The eighth annual report of The Canadian Westinghouse Company, Limited, for the year ending December 31, 1911, show that the net profits were \$1,010,153, an increase of 45 per cent. over the best previous year. The total assets of the company now amount to \$6,586,751. Extensions to the plant have been an important factor during the past year. The extensions to the warehouse, factory and pattern building were completed early in 1911, and the plant has been further increased by the new main machine shop aisle now nearing completion, after which the necessary machine tool equipment will be installed. The former boiler plant has been rebuilt with all labor saving appurtenances, and in such a way as to permit of the installation of extra units as required. The construction of all these buildings has been carried out on lines of solidarity and permanency.

The directors of the Canadian Westinghouse Company, Limited, are: George Westinghouse, president; H. H. Westinghouse, L. A. Osborne, vice-presidents; Paul J. Myler, vice-president and treasurer; T. Ahearn, Sir J. M. Gibson, Warren Y. Soper, C. F. Sise, Chas. A. Terry, F. A. Merrick is general manager; N. S. Braden, manager of sales; John H. Kerr, secretary. The principal office and works of the company are at Hamilton, Ont. District offices are located at Montreal, Toronto, Halifax, Winnipeg, Calgary and Vancouver.

Victor Insulators Stand the Test

At the recent meeting of the electrical section of the Canadian Society of Civil Engineers, at McGill University, when Professor A. M. Gray and Mr. A. McNaughton read a paper on "High tension insulation," a series of tests were made in the new high tension laboratory, which has recently been completed, and the plant of which is capable of giving as high as 200,000 volts. The tests were made on a number of high tension insulators, and owing to the fact that a shipment of sample insulators had gone astray it was necessary to press into service a part of the sample stock which the Locke Insulator Manufacturing Company keeps in Montreal with their agents, the Engineering Equipment & Supply Co. These samples are not generally intended for test but rather to show the general shape and appearance of the insulator, and in most cases were considered as seconds. In no case, however, did these Victor insulators show any tendency to puncture even when subjected to the severest tests; in most cases the samples were tested to flashover, both dry and wet, for periods in excess of sixty seconds without showing any unusual distress.

Highest d.c. Voltage in America

The illustration shown herewith represents a 1,500 volt electric locomotive which will operate on the lines of the Piedmont Traction Co., and is the first of six for this railway which will be built by the Westinghouse Electric & Manufacturing Co. This system represents the highest di-



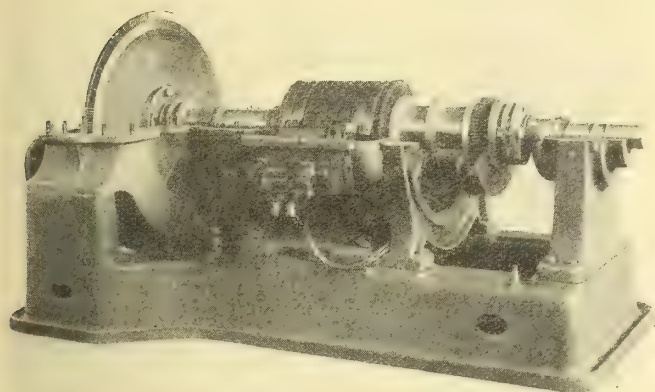
rect current voltage used by any electric railway in America. The locomotive weighs 55 tons and is equipped with four 180 h.p., 750 volt motors. It is calculated that each locomotive can haul 40 freight cars weighing 45 tons each when loaded, at a rate of 20.5 miles per hour on a level track.

Economic Heating Appliances

Royce & Company, manufacturers of electric heating appliances, West Toronto, have just issued an illustrated booklet describing their various electric appliances. These are all equipped with the Royce patent electric heating element, which has been patented in Canada, the United States, Great Britain, and other important countries. It is claimed for this element that comparative tests and continuous service over long periods have demonstrated that it is superior in durability to any other element yet devised. The equipment manufactured includes electric irons of various sizes, electric disk stoves, radiators, etc., etc.

Single Impulse Wheel Turbines

The accompanying sketch represents a Westinghouse one hundred kw. direct current turbo-generator set, with top casing removed, showing the single turbine runner and the armature. These sets are made down to 25 kw. size, and are available for such work as excitation for larger generators and for the supply of light to large buildings. As compared with reciprocating engine sets, the features in favor of the turbo-generator, as claimed by the manufacturers, are simplicity and reliability, compactness, lower cost of installation, less oil required. The turbine shown is of the single wheel impulse type with wheel or rotor



mounted directly on the end of the generator shaft. Although only one impulse wheel is used a high efficiency is obtained by using the steam two or three times on the same wheel. The governor is of the fly-ball type. In case of over-speed an automatic safety stop throttle valve is tripped, shutting off the steam supply.

The Metalized Filament Lamp

The metalized filament lamp, often erroneously designated the Gem, has become a most serious competitor of the carbon lamp in most of the larger cities of the United States. The Canadian Tungsten Lamp Company, anticipating their customers' requirements, have been experimenting with this lamp and will shortly place on the market the "Jewel," a metalized filament lamp, which, though similar in many ways to the Gem, has many special characteristics. It is claimed that the efficiency is very superior, while the useful life is considerably longer. The candle powers range from 16 c.p. to 150 c.p. and these can be used wherever a carbon lamp can, and will stand any amount of rough handling, while the life is approximately the same as the carbon. The additional price is soon compensated when the saving of current is taken into consideration.

The Davidson Electric Company

Under the name of the Davidson Electric Company, a new firm has been opened at 174 Notre Dame Street East in the city of Winnipeg, where a general contracting and supply business will be carried on. This company will specialize in the repair and maintenance of electro-therapeutic, laboratory and other fine electrical instruments, which, we understand, no other firm in the west handles to any extent. The new firm is composed of Jas. A. Davidson and Chas. E. Long, both practical electricians of many years' experience.

A New Insulating Compound

Mr. J. S. Wheeler, manager of The Flexible Conduit Company, Limited, of Guelph, Ontario, has just perfected a machine which automatically combines five of the best insulating materials known, including Varnished Cambric, into a flexible conduit, for use in transformer and power stations. Rigid tests of this material were exceedingly satisfactory, and a machine is now being installed.

Owing to the rapidly increasing demand for "Braiduct," The Flexible Conduit Company have doubled the capacity of their plant.

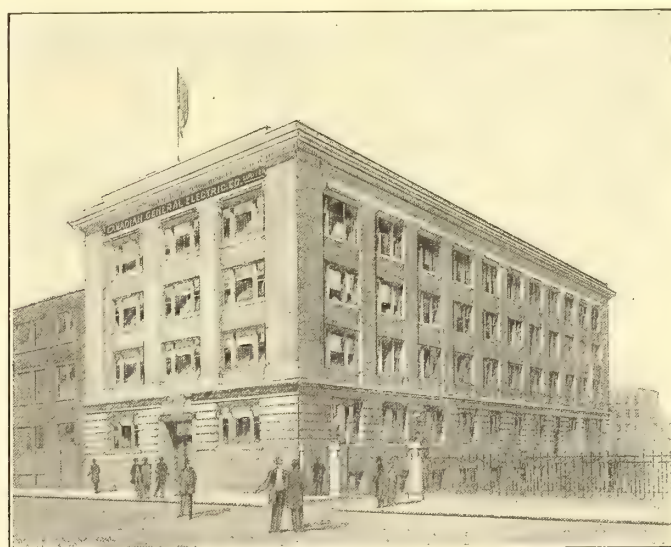
Moving to Larger Quarters

The Federal Engineering & Supplies, Limited, of Toronto, on April 1st moved their Montreal office from 329 St. James street to 369 St. James street, where they will have better facilities for handling their increasing business. The Federal Engineering & Supplies are Canadian headquarters for the Fedram tungsten, and the Fedram wire type tungsten; also the Federal carbon lamps. The Montreal office is in charge of Mr. R. B. Reid.

Mr. A. L. Woolf, the Winnipeg manager of the Canadian Tungsten Lamp Company, has just completed his usual spring trip through Manitoba, Alberta and Saskatchewan, his western territory. He states that notwithstanding the lateness of the spring, business prospects are good, and he has succeeded in signing up some very nice contracts.

New Montreal C. G. E. Building

The March issue of the Electrical News described a handsome office and warehouse building being erected by the Canadian General Electric Company in Montreal. Up to the present time this company have occupied a rented building in Montreal, the lease of which expires during 1912. The new building, shown herewith, will occupy a splendid site on St. Antoine street opposite the new Windsor sta-



tion of the Canadian Pacific Railway. The building is being designed by Messrs. Ross & McFarlane, architects, and will be constructed of cut stone and brick, and comprise five storeys and a basement. The office, showroom and warehouse floors will be equipped with every modern device for facilitating despatch of business and will afford ample space for the company's rapidly increasing trade.

Calgary Adding 2,500 Kw. Set

The city of Calgary has just awarded a contract for a 2,500 kw., 60 cycle, 3-phase, 2,300 volt turbo-generator. The complete equipment is being supplied by Messrs. Laurie & Lamb, of Montreal, and will consist of a Belliss & Morcom steam turbine, a Vickers, Limited, alternator, as well as an air pump, the necessary piping, etc.

The corporation of the city of Calgary have also placed an order with Messrs. Kilmer, Pullen & Burnham, Limited, for one 1,000 kw., 400 r.p.m., synchronous, self-starting, railway motor-generator set, manufactured by the General Electric Company of Sweden, to be installed in their new substation on Ninth avenue west, city of Calgary. Early delivery is called for and it is expected that the unit will be in complete operation in four months' time.

Proposed Wireless Extensions

Details have been published of the proposed arrangements between the Marconi Wireless Telephone Co. and the British Government for the establishment of an Imperial scheme of wireless communication. The governments concerned have agreed to proceed at once with the construction of high power wireless stations at London, Egypt, Aden, Bangalore (India), Pretoria (South Africa), and Singapore, and it is announced that this represents only the beginning of a scheme which will be ultimately extended throughout the British Empire, so as to render the government as far as possible independent of submarine cables. It is announced the stations will be operated for the first six months on account of the Government by the Marconi Company, and after that will be taken over by the Government. The company will be paid \$300,000 for each station, exclusive of sites, foundations and buildings, and are to receive

10 per cent. of the gross receipts of all the stations during the term of the agreement, which is for 28 years.

The Westinghouse Electric and Manufacturing Company are filling an order for a 400 kw., 60 cycle set, consisting of two rotary converters which operate in series, which will deliver current at 1,200 volts d.c. to the Hocking and Sunday Creek Traction Company, of Ohio.

A report from Quebec city states that the Federal Government has under consideration plans for an increased wireless telegraph equipment in that city. The present station in the Citadel is only a half-kilowatt one, and it is impossible to get communication with Father Point or Montreal without relaying at the stations at Grosse Isle or Three Rivers.

At a well-attended noon luncheon of the Winnipeg Jovians on April 8th, Mr. Horatio A. Foster, of the J. G. White & Company, New York, delivered an interesting and timely address on Public Service Commissions, outlining the plans on which the various state commissions work in the United States, the difficulties that beset their path of providing proper supervision and control over the various public utilities, and the advantages of such supervision to the corporations as well as to the people.

The April issue of the Electrical News contained an illustrated description of the town of Waterloo's ornamental street lighting system, in which credit was given to Mr. George Grosz, engineer of the town, for the installation, and to another gentleman for the layout of the system. It has since been called to our attention that Mr. Grosz had charge of both the planning and installation of this model plant, and we have pleasure in making the correction.

Current News and Notes

Aura Lake, Ont.

The Porcupine Power Company has under consideration the construction of a regulation dam on the Grassy River.

Brockville, Ont.

Bylaw to make contract with Hydro Commission carried by big majority.

Bassano, Alta.

The Bassano Power & Traction Company will require new equipment shortly.

Brantford, Ont.

The city will vote on a by-law to spend \$109,000 on a hydro-electric distribution system. This will not include any underground work.

It is announced here that the Dominion Government will guarantee a subsidy of \$6,400 per mile to the Lake Erie & Northern Traction Company to build a line from Galt through Paris and Brantford to Port Dover.

Chatham, Ont.

Work has been started on an addition to the plant of the Chatham Gas & Electric Company and additional equipment will be ready for installation as soon as the foundations are laid.

Calgary, Alta.

In the Commissioners' report recently presented to Council a number of by-

laws are recommended, one of which is for the provision of a sufficient sum of money to build an underground conduit system.

The Electric Light Department during the three months ended March 30 showed a surplus of \$15,000.

Charlottetown, P.E.I.

A delegation from the P. E. I. Telephone Company consisting of President H. J. Palmer, manager W. S. Grant, director R. M. Johnson, together with Mr. Winfield, of the Nova Scotia Telephone Co., appeared recently before the city council with reference to the installation of underground conduit, which these companies favor. It is likely the city will co-operate and bear part of the expense.

Collingwood, Ont.

Mr. D. F. Streb, town electrician, has resigned, the resignation to take effect from June 1st.

Dublin, Ont.

This village voted to take power from the Ontario Hydro-electric Power Commission and will install a distribution system to compete with the acetylene gas which is the only lighting system available here.

Dunnville, Ont.

A new company to be known as the Marshall-Davis Limited, has been incorporated with powers to manufacture a full line of electrical apparatus and to contract for electrical construction. Vernon J. Davis is managing director.

Erindale, Ont.

The Erindale Power Company suffered a considerable loss from the recent flood which carried off part of their concrete dam.

Edmonton, Alta.

The surplus in the various departments for the month of March were as follows: Telephone, \$912; waterworks, \$459; electric light, \$15,106. The city railway still shows a deficit, which, however, is being gradually reduced.

Large contracts have been let for street work in connection with electric railway extensions. E. Manders, a city contractor, gets the major portion of the contracts. Work will begin as soon as the weather permits.

Fort Frances, Ont.

The application of the Ontario & Minnesota Power Co. for permission to build a dam at Kettle Falls at the head of Rainy Lake, regulating the flow of water at their power plant at Inter-

national Falls was heard before the International Joint Board of Commissioners for Canada and the United States at Washington, on April 2nd

Fernie, B.C.

A by-law will probably be submitted to spend \$15,000 on electric light extensions.

Guelph, Ont.

It is reported that tenders will be called for extensions to Radial Railway.

The Light and Heat Commission have made a slight reduction in the lighting rates as follows. For a consumption of 3,000 kw.h. per month, 7½c., and for amounts larger than this 7c.

Georgetown, Ont.

The Hydro-electric Commission has been requested to furnish estimates regarding the cost to Georgetown of 200, 300 and 400 h.p.; also the cost of a distributing plant for street lighting, domestic and commercial purposes.

Galt, Ont.

A 250 kv.a. synchronous motor will be installed at the pumping station.

Hamilton, Ont.

It is said that the Street Railway Co. will put 24 new cars on their system this year.

The lowest tender received for the cement poles for the distribution system in this city was \$4.75 for twenty-four foot poles and \$6.65 for thirty foot poles. 5,300 of the former and 1,200 of the latter will be required. This tender was from Hancock Bros., who get the contract.

Kenora, Ont.

Tenders were submitted for the supply of an 825 h.p. electric generator for this town by the Allis-Chalmers-Bullock Company, the Canadian General Electric Company and Siemens Bros. Dynamo works. Contract was awarded to the A-C-B Co.

London, Ont.

It is reported The London Street Railway Company will equip a car repairing plant and will purchase all necessary machinery.

It is said The Hunt Milling Co's. mill will be remodelled and latest machinery installed.

One hundred ornamental hydro lights with large white glass globes, cast iron standard and cement block base are to be installed at Springbank.

Lethbridge, Alta.

On April 8th the first sod of the Lethbridge Municipal Street Railway System was turned with due ceremony by Mayor Hatch. Superintendent Arthur Reid states that the system will be completed in August.

Montreal, Que.

Contracts have been awarded by the Bell Telephone Co. of Canada for the construction of a new telephone exchange.

Morrisburg, Ont.

A by-law was submitted on April 20 by the corporation of the village of Morrisburg, to close a contract with Mr. Jas. L. Sharkey to take over the municipal power plant and distribution lines. In 1906 the village of Morrisburg was

given authority to develop 1,000 h.p. from the Rapid Plat Canal. This water power is now leased to Mr. Sharkey, who will develop it to supply power to meet the requirements of the village.

Meaford, Ont.

Due to an accident to the Georgian Bay Milling & Power Company's dams this town is without electric light.

Medicine Hat, Alta.

Mr. John McNeely, of the Medicine Hat Milling Company, offers to buy up to 200 h.p. of electric energy from the city for which he is willing to pay \$20, or as an alternative he will build a 500 h.p. generating plant and sell the extra 300 h.p. to the city for an \$18 rate. The city can only supply him with a limited amount at present.

Melford, Sask.

The ratepayers passed the by-law providing \$2,500 for a telephone system.

McLeod, Alta.

The question of generating power from a water falls on the Old Man River to supply this city is being discussed.

Niagara Falls, Ont.

Plans are under way to reconstruct the municipal pumping plant and power house and change the location.

New Hamburg, Ont.

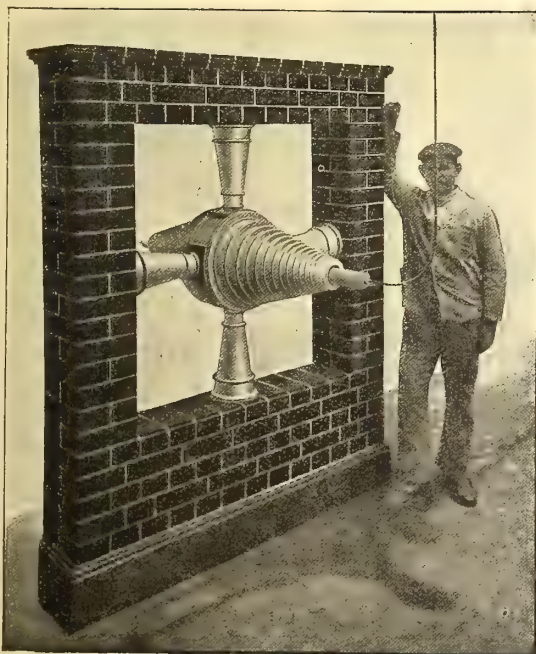
Electors will vote on a by-law to loan \$20,000 to an industry which will manufacture electrical supplies here.

North Battleford, Sask.

The proposed addition to the electric

Porzellanfabrik Hermsdorf

Sachsen-Altenburg, Germany



Wall Duct for the High Tension
Transmission Station of the

Hydro-Electric Power Commission of Ontario

110,000 Volts

Sole Agents for Canada

Watson Jack & Company

709 Power Building, MONTREAL

light plant will involve an expenditure of about \$30,000.

North Battleford, Sask.

Tenders have been called for a 150 h.p. engine and 500 kw. generator.

Ottawa, Ont.

Acting on the suggestion of the Hon. Adam Beck, the Dominion Government will in future subsidize only such electric lines in Ontario as will undertake to use exclusively electric power supplied by the Hydro-electric Commission.

Peterborough, Ont.

This city has been given the right by the Ontario Legislature to expropriate the plant of the Peterborough Light & Power Company, without compensating for the franchise. The franchise was given very recently and runs for twenty-five years.

Quebec City, P.Q.

The Dorchester Electric Company have announced that they will have a steam plant in operation by the first of November, and that later they will build a hydro-electric plant and keep their steam plant as a reserve.

Regina, Sask.

The cost of the municipal railway extension during the present year will amount to about \$150,000. Electric light extensions costing over \$80,000, and power plant extensions costing about \$40,000, will also be made.

Sealed tenders for the following will be received by the City Commissioners up to noon of May 15, 1912,—Luminous arc, street lighting equipment; street lighting poles, metal; draught fan; 400 kw. d.c. generating unit.

Sudbury, Ont.

A serious break in the penstock at the power house of the Wahnapiatae Power Company occurred on April 2nd.

St. Catharines, Ont.

The Canadian Crocker Wheeler Co. will erect an extension to their manufacturing plant.

St. Thomas, Ont.

The Council have decided to buy three new street cars, improve the overhead electrical construction and make extensions to street railway line.

Surgeon Falls, Ont.

A by-law was submitted on April 29th granting a franchise to the Northern

Ontario Light & Power Company for the purpose of constructing and maintaining poles and lines for the conveyance of electricity for heat, light and power to this town.

Thorold, Ont.

The Montrose Paper Company are asking tenders for 36 motors aggregating 900 h.p. and other equipment.

Toronto, Ont.

A railway bill introduced by Mr. W. K. McNaught compels an interchange of traffic between any two electric railways operating in close proximity to one another. A clause provides that the act shall not come into force except by the proclamation of the Lieutenant-Governor-in-Council. Where the two parties are unable to agree on the terms of interchange, the matter is to be decided by the Ontario Railway and Municipal Board.

The city of Toronto has been refused permission by the Ontario Legislature to expropriate that part of the Toronto & York Radial Railway Company's line between Sunnyside and a point near Long Branch, and which runs through the township of Etobicoke.

The Toronto Railway Company have announced that they will proceed with the re-building of their car barns immediately. Fireproof buildings of the most approved design and construction will be built.

The city of Toronto has been declared by the Ontario Legislature to have the right to operate an omnibus service on its streets, though the Toronto Railway Company opposed the claim on the grounds that this was an infringement of its franchise.

The Toronto Street Railway Company on its new summer cars will try out the system of a centre aisle with cross seats on each side.

By an addition to the Hon. I. B. Lucas' telephone bill, the incorporation of any private telephone system can be enforced by a three-quarter vote. It is necessary, however, that the shares of the remaining one-quarter must be bought out before this action can be taken.

Verdun, Que.

The town council has passed a by-law to provide \$229,000 for increased fire protection, extension of water, filtration and electric light plants, and for water mains, sewers and general improvements.

Vancouver, B.C.

The Britannia Mines Company, some forty miles up the coast from Vancouver city, will in the near future install a new hydro-electric plant. It is said this plant will operate under the highest head to date in Canada, at 1,800 feet.

Vernon, B.C.

This town is negotiating with the Couteau Power Company for a supply of electric power. This company owns the power site at the Shuswap Falls, some twenty-five miles east of here.

Wheatley, Ont.

It is reported that complete new machinery for an electric light plant will be installed. Marvin White, owner.

Wetaskiwin, Ont.

The by-laws to expend \$39,000 on waterworks and power plant both carried; of this amount \$23,000 is for electric lighting purposes.

Moonlight Schedule for May 1912

Courtesy of the National Carbon Company, Cleveland, Ohio.

Date.	Light.	Date.	Extinguish.	No. of Hours
May 1	No Light	May 1	No Light	
2	7 20	2	10 10	2 50
3	7 20	3	11 20	4 00
4	7 20	5	0 10	4 50
5	7 30	6	1 10	5 40
6	7 30	7	1 50	6 20
7	7 30	8	2 30	7 00
8	7 30	9	3 00	7 30
9	7 30	10	3 30	8 00
10	7 30	11	3 50	8 20
11	7 30	12	4 00	8 30
12	7 30	13	4 00	8 30
13	7 30	14	4 00	8 30
14	7 30	15	4 00	8 30
15	7 30	16	4 00	8 30
16	7 40	17	4 00	8 20
17	7 40	18	4 00	8 20
18	7 40	19	4 00	8 20
19	7 40	20	4 00	8 20
20	7 40	21	4 00	8 20
21	11 00	22	4 00	5 00
22	11 30	23	4 00	4 30
24	0 00	24	4 00	4 00
25	0 20	25	3 50	3 30
26	40	26	3 50	3 10
27	1 00	27	3 50	2 50
28	1 30	28	3 50	2 20
29	1 50	29	3 50	2 00
30	No Light	30	No Light	
31	No Light	31	No Light	

Total.....166 00

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Miners, Exporters and Dealers in
Canadian Amber Mica.
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Write us for prices and let us figure on your requirements.

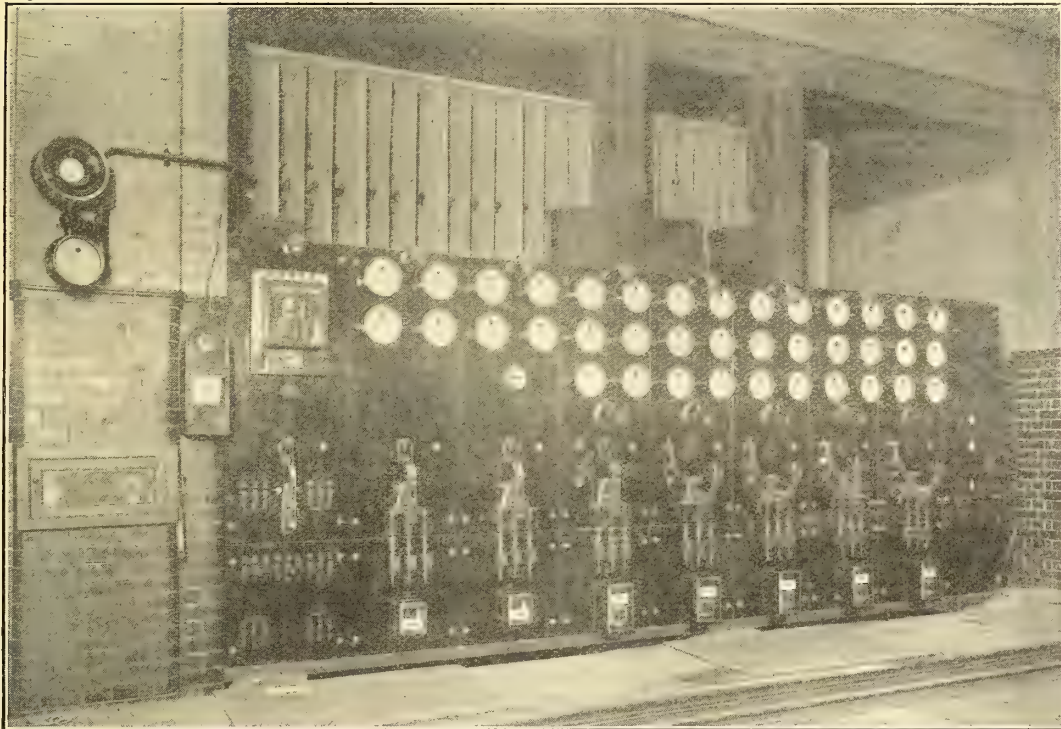
Tenders

A few dollars spent in advertising
your proposals in

The Contract Record

would result in additional competition,
which might save your city or town or
your client many hundreds of dollars.

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Siemens 9 Panel High Tension Switchboard

The Siemens Companies manufacture and have in successful operation switching apparatus up to and including 110,000 volts. The solidity of construction, general design, and finish of our apparatus has often been favourably commented upon by Canadian Engineers

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Condensed Department

RATE

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Positions Vacant } tion.
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Tender advertisements, equipment for sale, etc., 15 cents per agate line (14 agate lines make one inch) per insertion.

Advertisers who wish to conceal their identity may do so by using an Electrical News box number without extra charge.

Forms close on the 18th of each month.

Situations Wanted

Electrician with large experience in transformer work, design, testing and building, motor installations, repair and trouble work, A. C. and D. C., is open for engagement and desires to hear from power companies and others; age 32. Apply Box 485, Electrical News, Toronto, Ont. 5

Position Wanted

Gentleman, M. I. Mech. E. expert in design and construction of cranes and hoists, all types and sizes, electric, steam, hand; 20 years' practical experience in Britain, Germany, United States, seeks leading position with good firm. Reply Box 483, Electrical News, Toronto, Ont. 5

Position Wanted

Electrical and mechanical training supervision of duct and pipe laying, cable installing, high and low tension underground distribution. Apply Box 484, Electrical News, Toronto, Ont. 5

Manager Wanted

to manage The Saugeen Electric Light and Power Company's business at Southampton. Apply, stating qualifications and salary asked. References required.
Saugeen Electric Light & Power Company, Ltd.,
Walkerton, Ont. 5

Wanted Superintendent

Superintendent for the Electrical and Water Works Department in a town of 7,000, to take care of distributing system. Applicant must have full knowledge of all out door work, instal services and make repairs. State full particulars and salary required; duties to commence May 15th, 1912. Address Box 476, "Electrical News," Toronto, Ont. 5

Situations Vacant

REPORTER

We want an energetic representative in each town in Canada to report on building and engineering work—to tell us where machinery, equipment, supplies or materials may be sold. Reports are paid for on the per item basis. It depends upon your own efforts how much you make. This is a profitable side line and there is good money in it for a hustler. Write to MacLean Daily Reports Limited, 220 King street west, Toronto.

For Sale

Ayr electric light plant in first class condition, steam power, good service and contracts. Exclusive franchise in town of 1,200. A splendid chance for a practical man. Being sold because of owner's death. Apply D. M. Clark, 15 McKenzie Crescent, Toronto, Ont. 2-TF

Plant For Sale

Electric light plant and water power in Western Ontario, at present rented and in good running order. Also farm, on which plant is situated, suitable for grazing or cultivation. For further particulars apply to R. C. Pearce, Paisley, Ont., or D. McIntyre, 1943 Smith Street, Regina, Sask., proprietor. 3-6

Articles For Sale

An Improvement in Gas Lamps and Heaters as manufactured in Canada in conformance with Canadian Patent No. 124,252, can be obtained, and orders for the same will be received by Lloyd Blackmore & Co., 17 Elgin St., Ottawa, Canada. 5

Business Chances

The present holders of Canadian Patent No. 124,252, for improvements in Gas Lamps and Heaters, are willing to dispose of the same outright or under royalty agreement, and in view of the many advantages of the invention an excellent opportunity is afforded for parties desirous of carrying on the manufacture of the same in Canada.

The device is being manufactured by Messrs. Latham & Groves of Ottawa, Canada, and further particulars of the same can be obtained from Messrs. Lloyd Blackmore & Co., 17 Elgin Street, Ottawa, Canada. 5

NOTICE

The undersigned are prepared to grant licenses at a reasonable price to anyone desiring to use the method of laying conduits described and claimed in Cahn and Seeberger's Canadian Patents 124,562 and 124,563, dated March 22, 1910. They are also prepared to receive offers for the purchase of the patents or for licenses to manufacture the machinery required to practice said processes. Ridout & Maybee, Manning Chambers, Toronto, attorneys for the patentees. 5

Electrical Books

A number of Electrical Books are offered for sale at about one-half their cost. They embrace a large number of subjects, such as Notes on Electro-Chemistry; Practical Alternating Currents and Power Transmission; Elementary Principles of Continuous Current Dynamo Designs; Standard Polyphase Apparatus and Systems; Stray Currents from Electric Railways; Electric Lighting and Power Distribution; Transmission Calculations; Telephone Construction, Operation and Maintenance, etc.

These books may be seen at the office of the Electrical News, 220 King street west. Particulars regarding any book will be furnished on request.

For Sale

New 500 B.H.P. Mirrlees-Diesel crude oil engine, 200 r.p.m. delivery six weeks. Guaranteed fuel consumption full load 0.45 lbs. b.h.p. hour. Apply, Heaps Engineering Co. Ltd., 445 Hastings street, Vancouver, B.C.

CITY OF REGINA, SASKATCHEWAN

Sealed tenders for the following apparatus and supplies will be received by the City Commissioners, City of Regina, up until noon of the 20th April, 1912, for sections 1 to 5, and up until noon of May 15th, 1912, on sections 6 to 9.

Section 1.—Poles, cross arms, side brackets, top pins.
Section 2.—Pole line hardware.
Section 3.—Copper wire.
Section 4.—Transformers.
Section 5.—Meters.
Section 6.—Luminous arc, street lighting equipment.
Section 7.—Street lighting poles, metal.
Section 8.—Draught fan.
Section 9.—400 kw. d.c. generating unit.

Tenders will be received for the whole or any section of this work.

The lowest or any tender not necessarily accepted. The city reserves the right to waive any irregularities in any tender.

Specifications for any or all of these sections may be had on application to the

CITY ELECTRICIAN,

5

Regina, Sask.

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SYNCHROSCOPES.**

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and New Models of Weston D.C. Instruments to match

This whole group of instruments embodies the results of several years exhaustive study and scientific investigation of all the complex electrical and mechanical problems involved in the development of durable, reliable, sensitive and accurate instruments for use on alternating current circuits.

Every detail of each of these instruments has been most carefully studied and worked out so as to be sure that each shall fully meet the most exacting requirements of the service for which it is intended. Neither pains nor expense has been spared in the effort to produce instruments having the longest possible life, the best possible scale characteristics, combined with great accuracy under the most violent load fluctuations and also under the many other trying conditions met with in practical work. Every part of each instrument is made strictly to gauge and the design and workmanship and finish is of the highest order of excellence.

We invite the most critical examination of every detail of each member of the group. We also solicit the fullest investigation of the many other novel features and very valuable operative characteristics of these new instruments and request a careful comparison in all these respects with any other make of instrument intended for like service. We offer them as a valuable and permanent contribution to the art of electrical measurement. Their performance in service, will be found to justify the claim that no other makes of instruments approach them in fitness for the service required from A.C. Switchboard indicating instruments.

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New Haven, 29 College St.
Cleveland, 1522 Prospect Ave.

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Berlin, Genest St. 5 Schoenberg.
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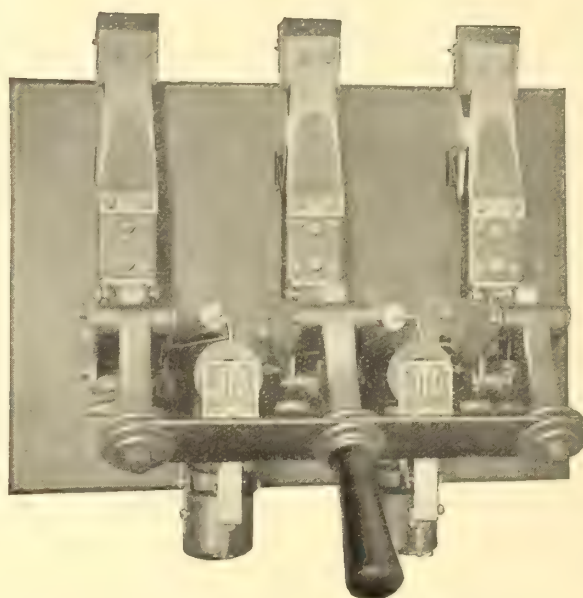


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is a sturdy piece of apparatus, but staunch though it is there are many exigencies of service from which it should be given such protection as can best be secured by the use of a properly chosen

I-T-E Circuit Breaker



The Type "W," three pole, Time Limit (DALITE) Circuit Breaker shown herewith is admirably adapted to the protection of induction motors operating under a wide variety of conditions. This form, together with others covering practically the entire range of industrial service, is described in our new

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We beg to announce the formation of a new firm to succeed the Canada Ford Company Limited under the name of

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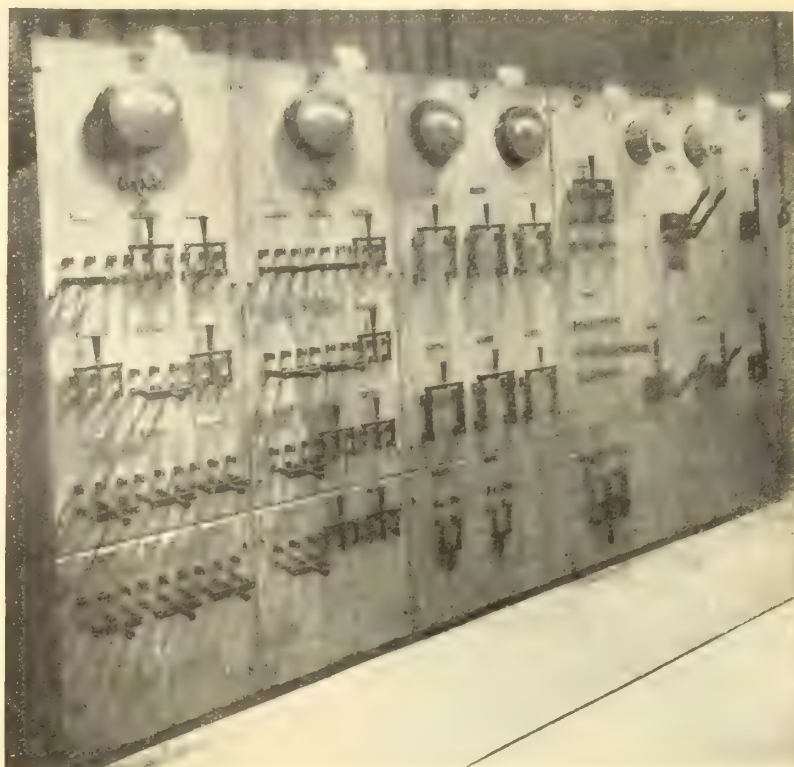
This firm will represent as did its predecessor The Brush Electrical Engineering Co'y. of Longborough, dealing in their complete line of Electric Rolling Stock, Electric Machinery and Electric Supplies.

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We have taken over the Canada Ford Building on St. James St. and will be glad to see all our old friends as usual, trusting for a continuance of the same kind patronage as was given the Canada Ford Company Limited.

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Peirce Brackets cost more in your warehouse but less on your patrons' buildings than other brackets. They are hot galvanized and made of hot rolled channel steel. The insulator springs are resilient spiral springs, which prevent the breakage of insulators. They allow for the inequalities of insulator bores. This resilient thread is of especial importance in Northern latitudes where wide ranges of temperature cause excessive expansion and contraction of cast iron brackets.

Our Catalogue Lists Sixty Different Styles

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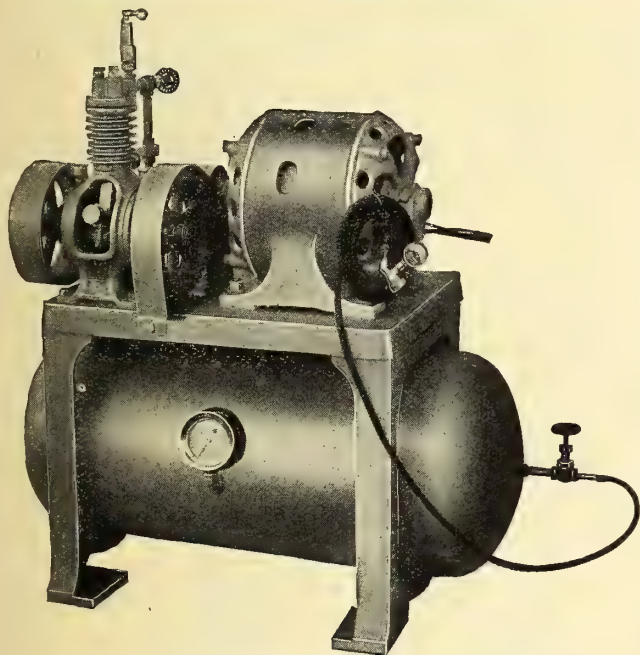
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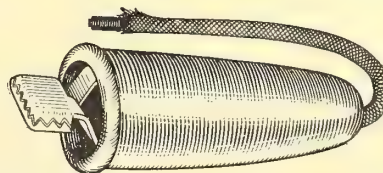
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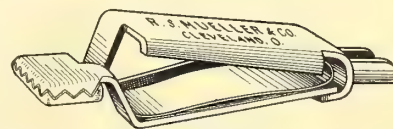


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8 inch Drawn Shell
Residence Fan

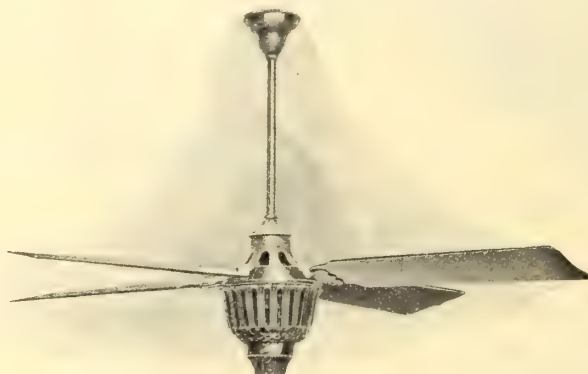


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Can be used
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2 or 4 Blades

Fans stocked for all Standard Circuits

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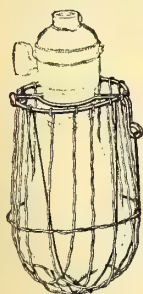
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Royce & Co., Manufacturers, West Toronto, Ont.

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WIRE LAMP GUARDS.

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The Chicago Conduit Rod Coupling

(U.S. and
Canadian
Patents)

Best answers
the purpose
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Used
by leading
Lighting, Trac-
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Companies in the
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who have recognized its superior
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This coupling makes a joint that is a
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Most plugs are too big for small electrical devices. Hubbell Plug No. 5749 is a little fellow—the littlest of all separable plugs. Small enough for any device, large enough for any service. The neatest and handiest plug for fans, portables, toasters, percolators, etc. Made of tough composition. No danger of breaking when dropped on the floor or carelessly used. Concealed contacts. Easy to wire and plenty of room. Round contact posts. If you haven't had a Free Sample, send your name and say where you saw this Ad.

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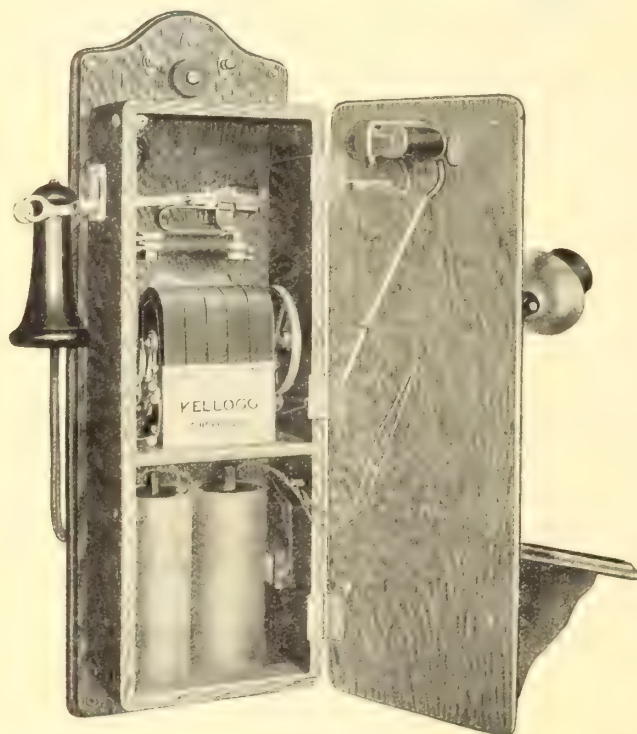
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USED SUCCESSFULLY ON THE HEAVIEST LOADED LINES



THE NEW KELLOGG 5 BAR TELEPHONE (COMPACT TYPE)

To every telephone man who will install one or more telephones this spring, we say:

If it's the heavy service magneto rural or farm line in which you are interested here is a telephone unequalled at any price for certain signalling, clear transmission, long life.

Code No. 2696 complete (less batteries.)

Standard Kellogg; 5 bar generator, Local and long distant transmitter, "Long service" receiver, "Fool proof" ringer, Induction coil, Long lever switchhook, Oak cabinet (Dovetail Joints—built for years of service.)

Pure platinum contacts in hook-switch and generator springs.

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If you prefer other types, if you wish switchboard quotations, if you want to know about our moisture proof cords, our indestructible desk stands, metal reinforced rubber receivers and mouth pieces, write us. Just add I saw your announcement in Canadian Electrical News.

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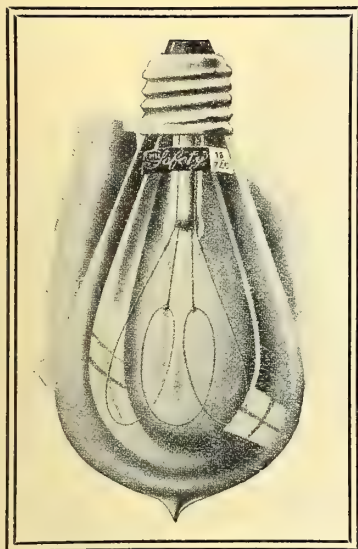
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We are Headquarters for anything in Incandescent Lamps

TUNGSTEN

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A lamp that will meet class A specifications. Can furnish either 3.1, 3.5 or 4 watts per candle. Try an assorted lot at our case lot price 13 cents. This is certainly a splendid lamp.

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Excello Lamp
Size f
with 'Dioptric'
light-spreading
globe

There may be two meanings of the word

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1. Generic - any flame arc lamp.
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Buy **any** lamp if you want trouble
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The only lamp with the
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and
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25 cycle
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size e
with deposit—
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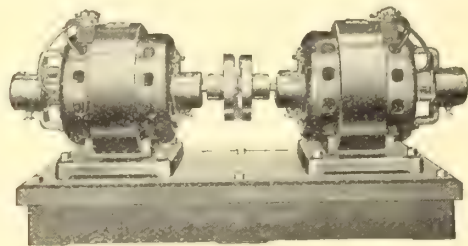
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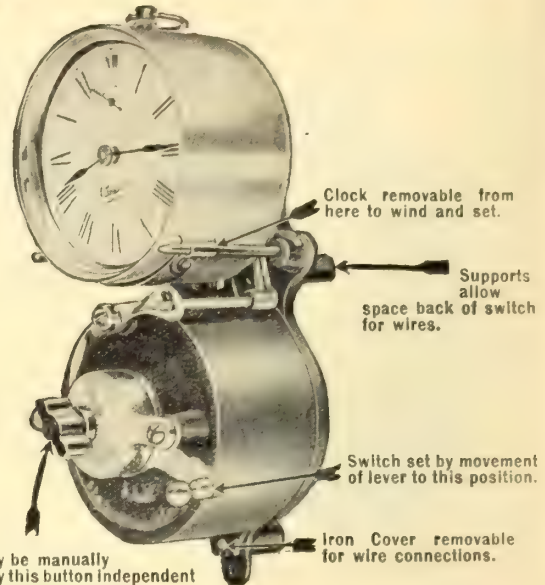
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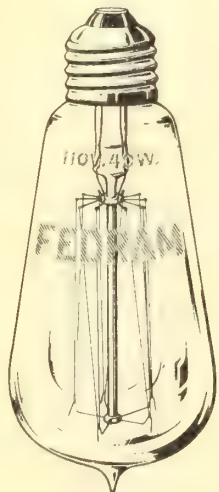
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TYPE "A"

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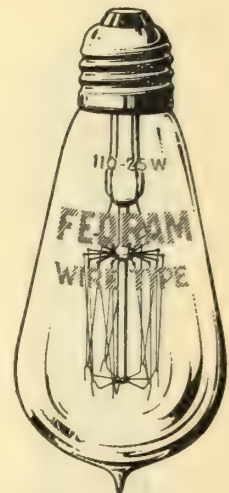
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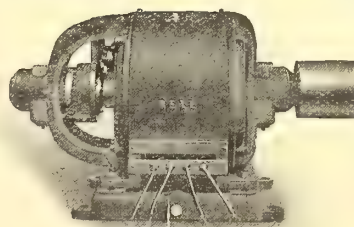
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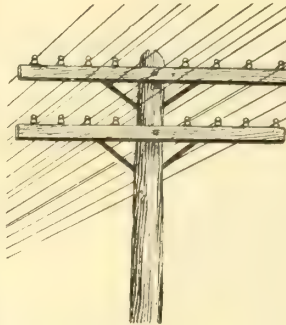
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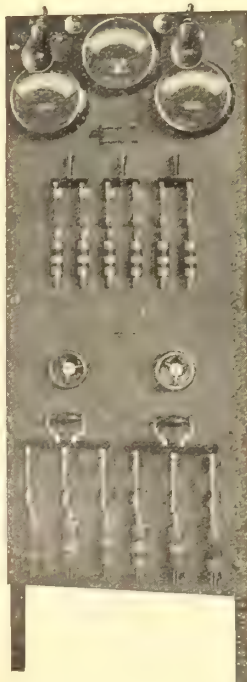
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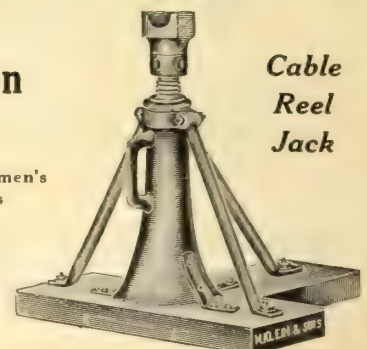
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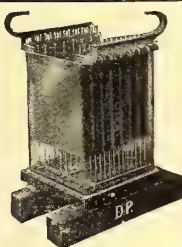
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Cedar

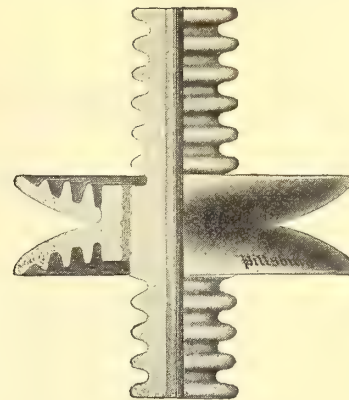
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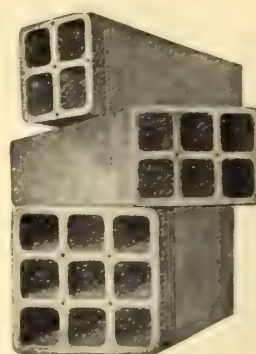
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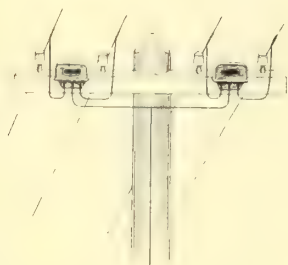
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Catalogue ?

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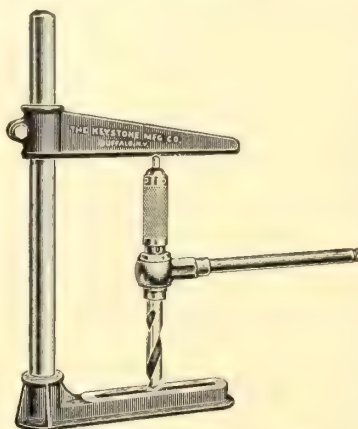
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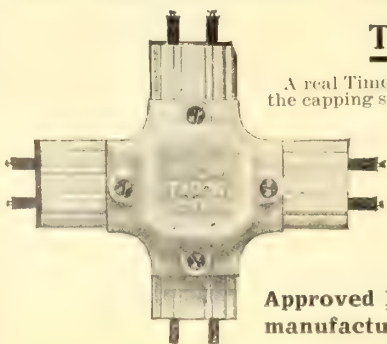
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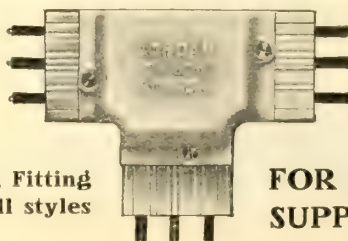


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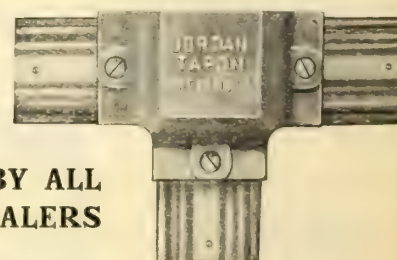
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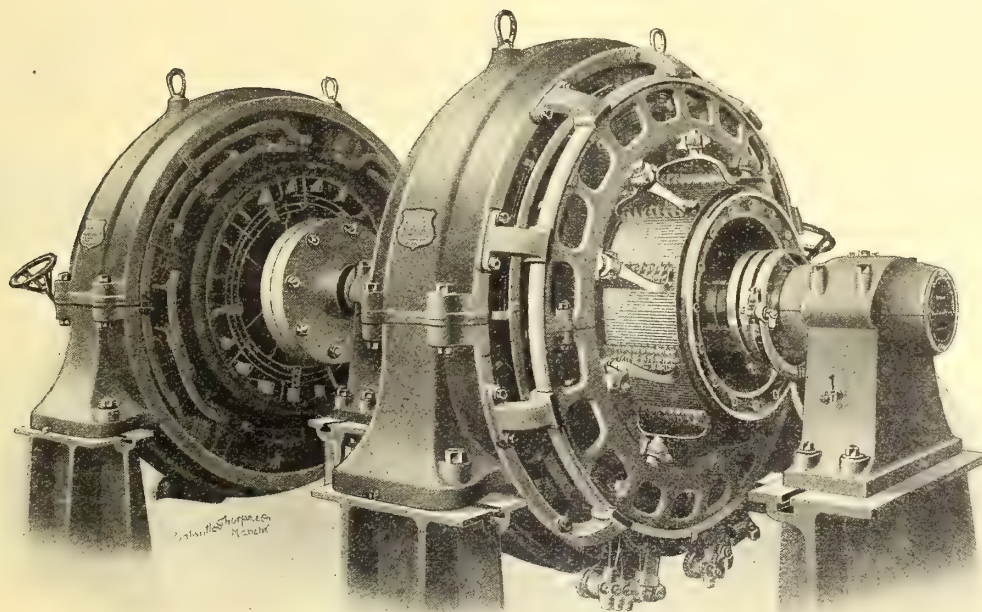
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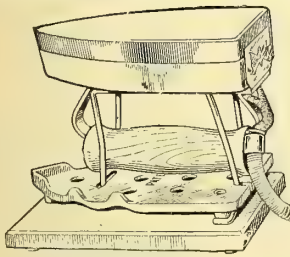
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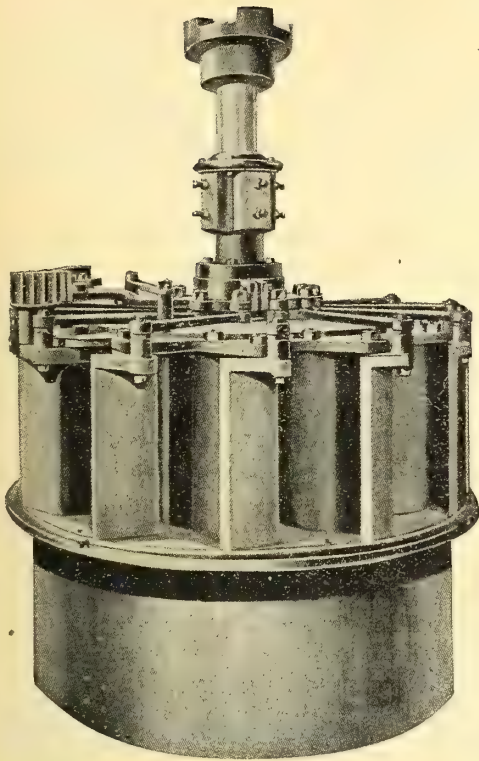
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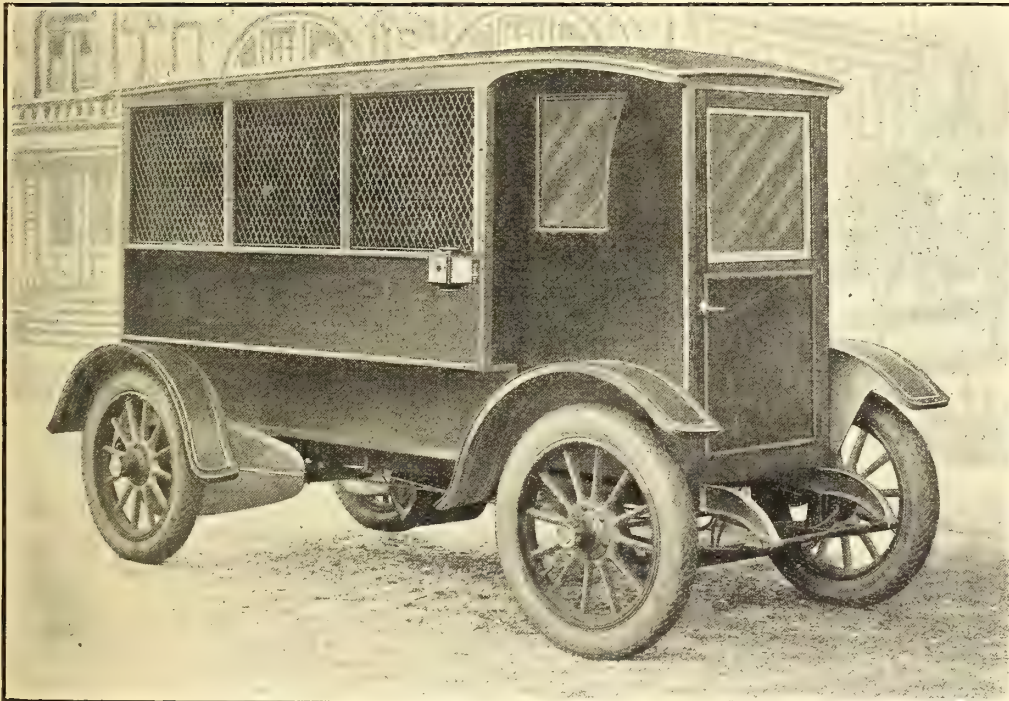
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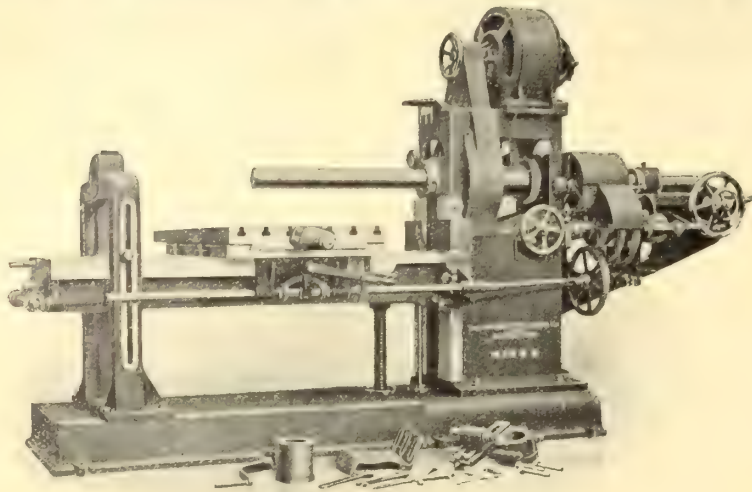
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 Bolts—Plain and Hot Galvanized, Wood Screws,
 Wire Nails, etc.

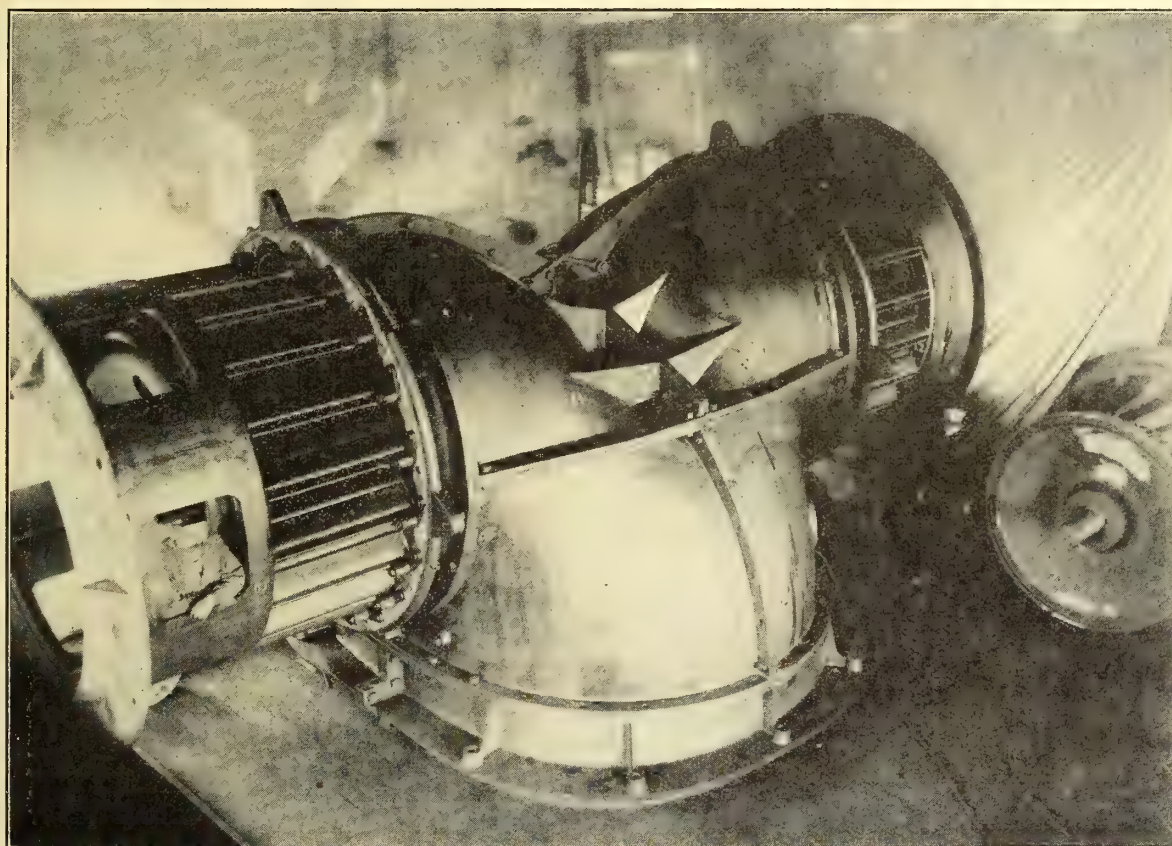
Send us your inquiries and let us quote on same

THE CANADIAN BÖVING CO. LIMITED

have supplied

FOUR 1400 H.P. VERTICAL SHAFT TURBINES

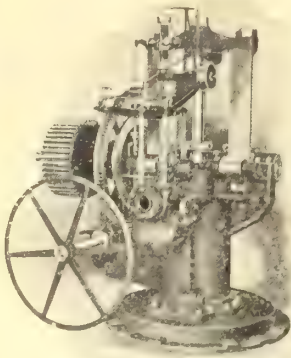
in Open Flumes, operating under 20 feet head at 120 r.p.m. for the POWER HOUSE at DAM NO. 2, TRENTON, ONT., complete with GOVERNORS.



This Picture shows one of the Turbines taken in a horizontal position at the erecting shops. A REPEAT ORDER for Four Similar TURBINES AND GOVERNORS for the Power House at Dam No. 5, Trent River has recently been received.

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60,000 ft. lbs. capacity

WE MAKE

Water Wheel Governors in 25 standard designs. **Water Wheel Governors** of special design to meet special requirements. **Mechanically Operated Relief Valves** which are absolutely positive in action. **Governors** for large Steam Engines. **Governors** for Large Gas Engines, **Frequency Recorders** for switch-board gallery or office use. **Precision Tachometers** or Speed Indicators. **Long Distance Speed Indicators** for office use. **Speed Recorders.**

We Guarantee All of our Product to be the Best Procurable, and will be glad to correspond with you in reference to any of it.

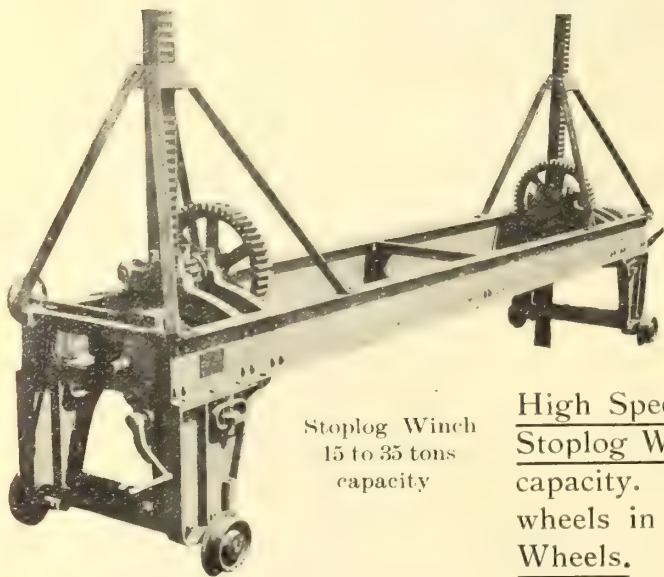
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Wm. Kennedy & Sons

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Stoplog Winch
15 to 35 tons
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Complete Water Power Installations

High Speed efficient Turbines. Headgate & Stiffleg Stoplog Winches, all sizes up to 35 tons pushing down capacity. Heavy Machine Cut Gears, Pulleys, Flywheels in Steel or Iron. Largest Stock Propellor Wheels. Steel Iron and Bronze Castings.

Felton's Improved Couplings

for Conduit Rods Have Many Superior Features

They are quickly coupled and uncoupled.

They cannot separate while in use.

They may be turned in either direction without unlocking.

They are least liable to get out of order

We believe they are the best couplings on the market. A sample will convince YOU. You have only to ask for it. This Coupon brings sample. We want you to send for it.

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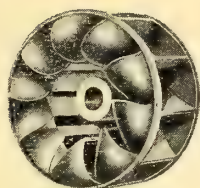
Harold L.
Bond Co.
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Please send sample of Felton Coupling and Catalog. Am interested in Conduit and Sewer Rods. Please quote prices and terms. It is understood that I do not obligate myself in any way to do business with you

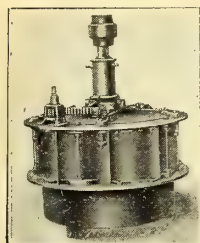
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Address.....

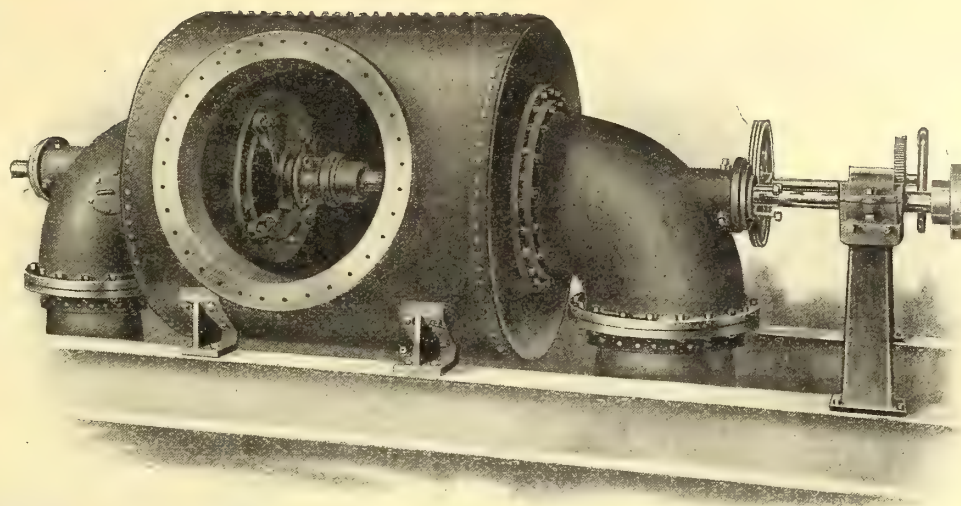
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Our customer for the above turbines writes:-

"The pair of water wheels installed is giving perfect satisfaction under the 70 feet head. Think I have the best outfit for its size in Ontario."

The Canadian Turbine is normal in speed and discharge. No over-rating or over-gating; satisfaction assured.

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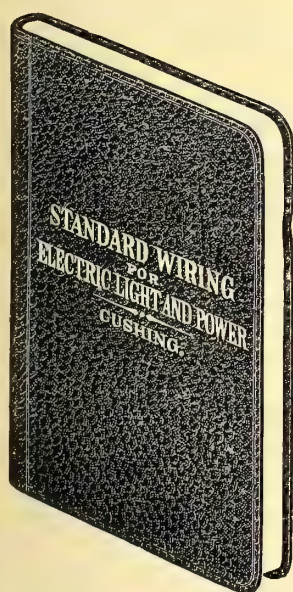
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*Member American Institute of Electrical Engineers; formerly
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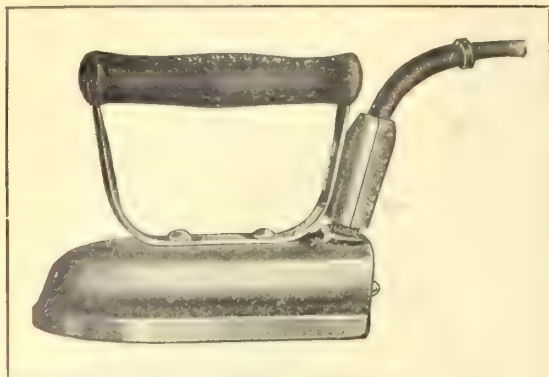
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We carry the very best line of heating appliances. They sell on sight. It will pay you to **see our line** before buying.

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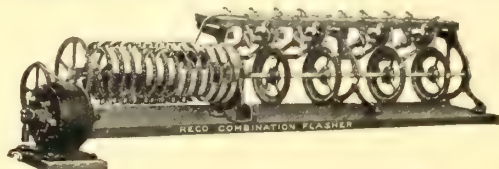
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Requires no solder, no heating torch, and
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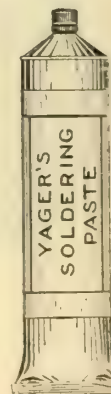
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Send us blue prints or models for estimates.

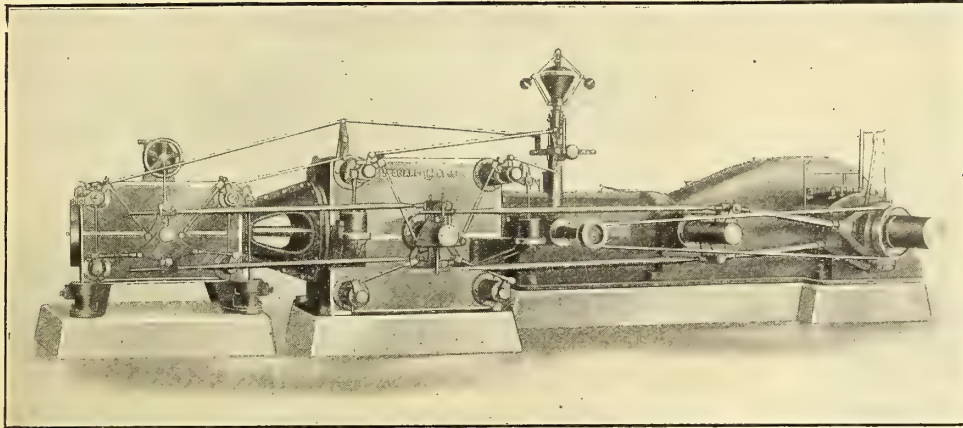
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Yeager's Soldering Salts have been the standard for 35 years and there are none better for **Quality and Service**. We now offer "YAGER'S" **FLUXES** made from the base of Yager's Salts, in four forms to suit your convenience. Salts, Stick, Paste and fluid. All non-acid fluxes that make perfect electrical joints stronger than original.



Leonard Corliss Heavy Duty Tandem Compound Engine



for Medium and
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Built in Units up
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Power

These engines are
Absolutely Noiseless,
are of **Massive Design**
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MANUFACTURERS OF

High and Slow Speed Engines of all kinds, Boilers, Heaters, Tanks and Steam Plants Complete.

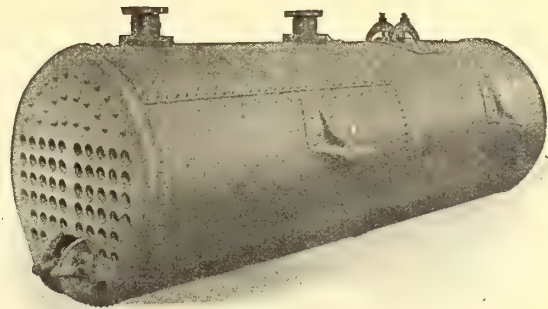
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What we mean by advertising our Boilers as "Built Right"

With boilers designed and built to standard specifications and made to pass the same inspection, it would seem that a boiler built in one shop should be as good as that built in another. It should be—often it is—but just as often it is not.

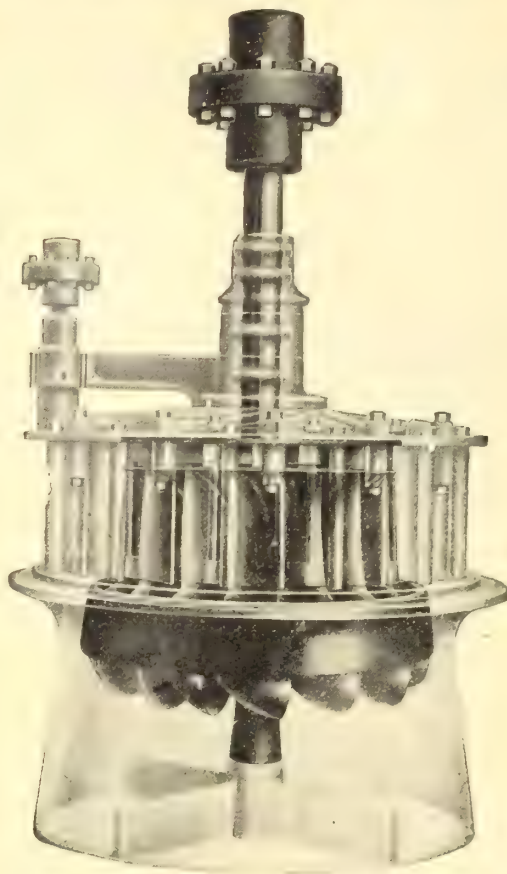
By combining the facilities and tool equipment offered in a shop as large as ours, with the constructional kinks and little "know hows" learned in our fifty years of boiler making, we turn out our boilers with a snap and finish that stamps them as **Built Right**—Waterous made—before you read the name plate.



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RETURN TUBULAR
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Water Wheels of Merit

The SAMSON wheel at official Holyoke tests has reached efficiencies of over 89 per cent. at $\frac{3}{4}$ and $\frac{7}{8}$ gate opening.

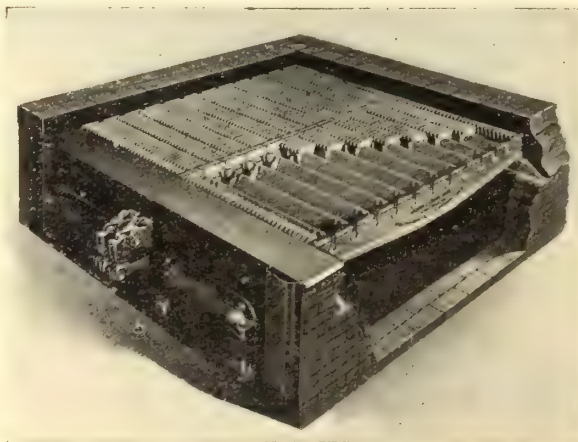
The great value of these Holyoke tests is to indicate the possibilities of a turbine; and, therefore, a wheel which shows high efficiencies there is likely to work correspondingly well under actual operating conditions.

And because no other wheel has yet shown such high efficiencies, the Samson is evidently THE wheel for you to use.

The William Hamilton Company
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You can change the grade of coal without getting a new grate. Simply take off the detachable tops and put on new tops having correct air openings



Macdonald Shaking Grate

You save in repair expense for you don't need to replace the whole grate simply because a small part is burned out.

More air—better combustion with this shaking grate, for with the same motion of the operating lever the points penetrate into the fuel about twice as far as with other types.

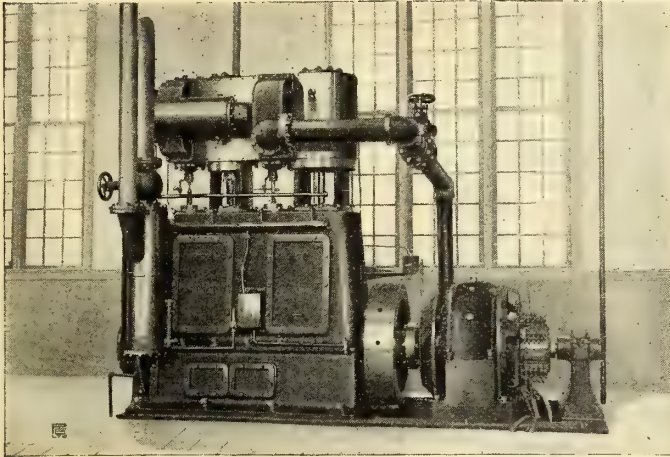
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Vertical High Speed Steam Engines

Especially designed for Direct Connection to Electric Generators.

Economical in Upkeep and in Floor Space required.

Illustration shows one of our Vertical High Speed Steam Engines recently installed.

This Engine is 150 H. P. Direct Connected to 100 K.W. Generator.

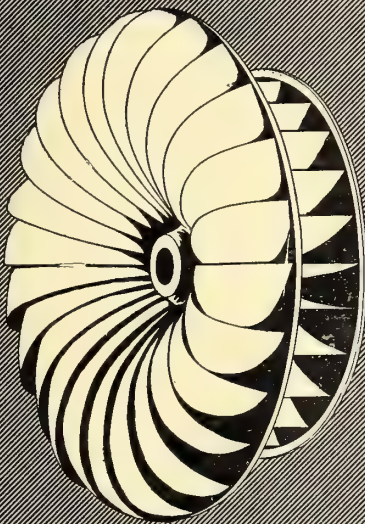
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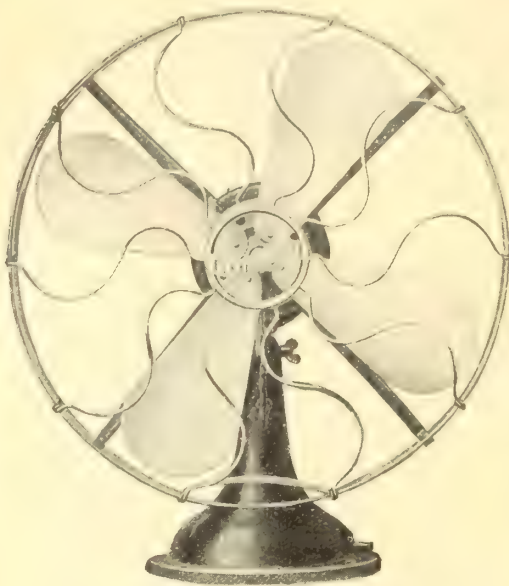
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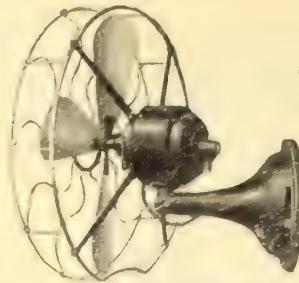
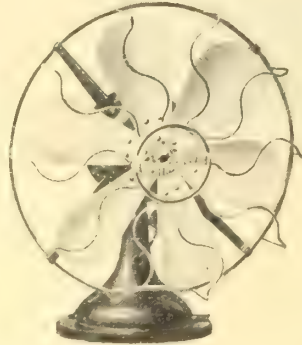
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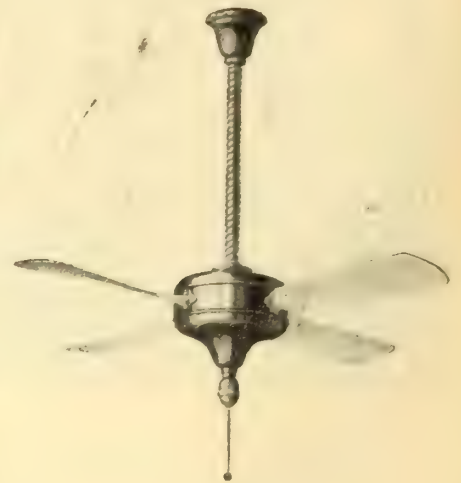
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12 in. and 16 in. Desk and Bracket

Arranged as Bracket Fan
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Unquestionably the most satisfactory and most attractive fans
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The drawn steel body and base give the greatest strength with the least weight; they are 20 to 40 per cent lighter than cast iron fans of equal size. This means easier handling and lower freight charges.

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Westinghouse Steel Frame Fan Motors comprise a complete line for all commercial circuits. 12 in. and 16 in. Desk and Bracket, 12 in. and 16 in. Oscillating, 12 in. and 16 in. Exhaust, Residence, Ceiling, Floor and Counter Column. The 8 in. Desk-and-Bracket and Telephone Booth types are made of drawn brass.

Send at once for our 1912 Fan Motor Circular No. 1165 describing the line in full and ask about our 1912 fan motor contract proposition for Central Stations and dealers.

We are prepared with large stocks to make prompt shipments.

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Quick Thorough Repairs to all makes of Electrical Apparatus.

Remote Control Solenoid Switches for economical tungsten or incandescent street lighting from existing house lighting system.

The Best Carbon Brushes in America for Electrical Machinery.

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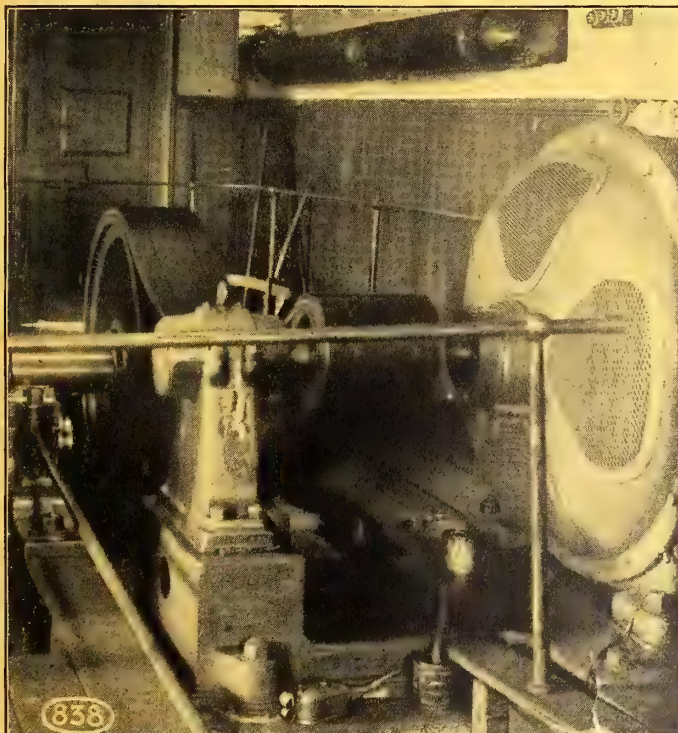
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(Hans Renold are the oldest and largest manufacturers of Steel Driving Chains in the world)



(Renold Silent Chain driving 150 H.P. Main Colliery Haulage Gear)

**TRANSMITS ANY POWER FROM
 $\frac{1}{4}$ H.P. to 2,000 H.P. QUIETLY**

Send us following details of any troublesome drives or new drives and we will give promptly full information re chain driving.

Maxim H.P. to be transmitted

Distance between centres of shafts

Revolutions per minute

Diameter of shaft

DRIVER	DRIVEN

Is a split sprocket wheel necessary? Yes or No

What is the chain required to drive

Can Shaft Centers be adjusted

Is the load steady or impulsive, as with pumps

Is the drive perpendicular or horizontal?

A Sketch of the drive is always of great assistance

JONES & GLASSCO

Sole Canadian Agents

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WHAT CAN WE SELL YOU? CAN WE LOAN YOU? HAVE YOU TO EXCHANGE?

We can KEEP YOU RUNNING while we make your Repairs.

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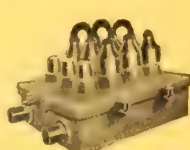
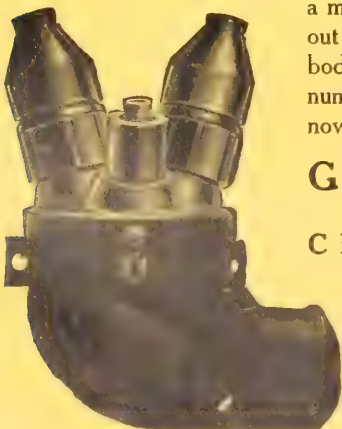
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MAKE CABLE ENDS SWITCHING POINTS

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HEATH
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"Osram" Wire-Drawn Lamps

"The Lamp with the Largest Sale in the World"

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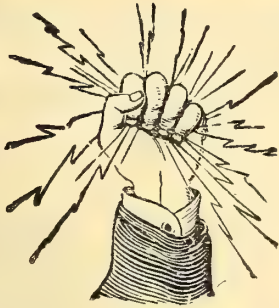
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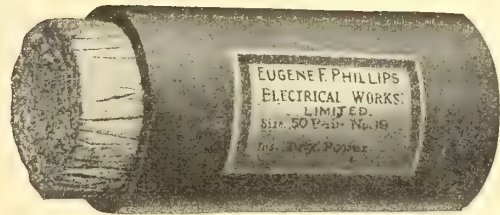
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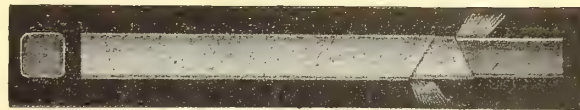
For Telephone, Telegraph, Lighting,
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Bare and Insulated Electric Wire and
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Railway, Feeder and Trolley Wire

Weatherproof Magnet
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Incandescent and Flexible Cords

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Branches: Halifax, Toronto, Winnipeg, Vancouver

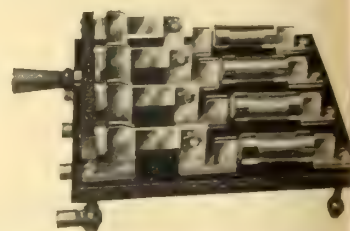


Factory Now Fully Equipped

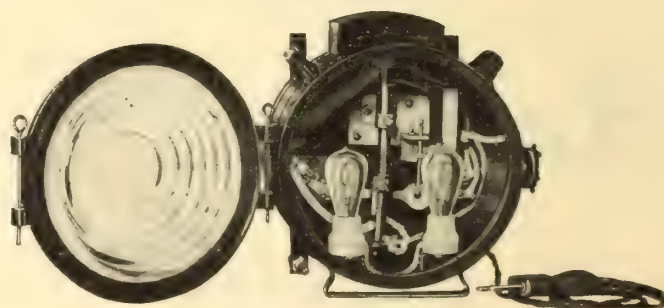
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One of the great number of Condulets, there being a distinct type and style for each separate conduit requirement.



Standard Knife Switches up to 500 amperes—Front or Back Connection; One to Four Poles; Single Throw; with or without Fuses. Also a complete line of Radiometer Switches—Voltmeter, Ammeter and Ground Detector.



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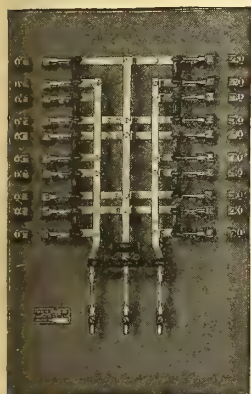
Main Office and Works :

Toronto, Ont., Canada

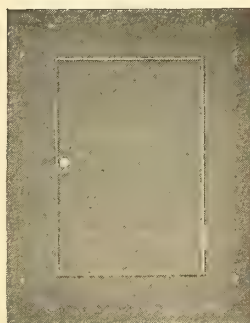


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The Crouse-Hinds Company of Canada, Limited, has all the Facilities to Permit and Exercises Every Care in the selection of Material and in the Course of Manufacture to turn out Highest Quality Products. Quotations submitted on Special Designs.



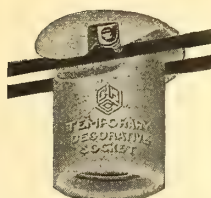
Panelboards—Many hundred standard designs for 125 and 250 Volts having N. E. G. Enclosed or Plug Fuses in Branches, with or without Knife or Snap Switches. Also Through Feed, Convertible, Meter Loop and Metering Panels.



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Closed Open
Harpoon Guy Anchor

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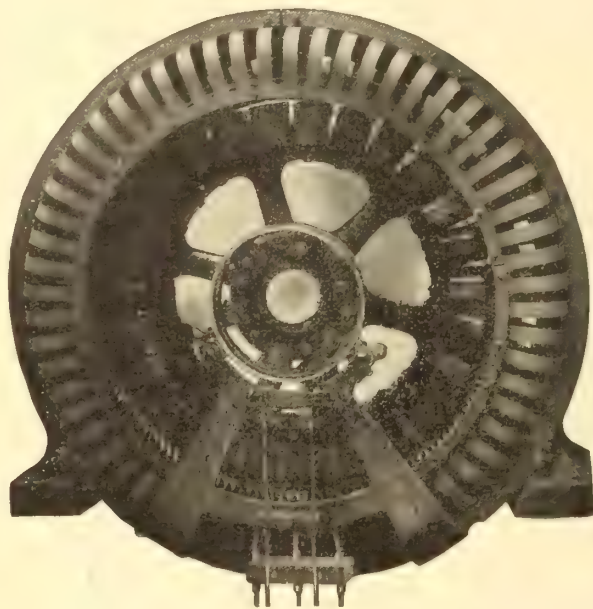
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Westinghouse

Alternating-Current Generators



These generators are arranged for direct mounting of the rotor on the shaft of the prime mover and are especially suitable for the prevailing conditions in industrial plants and central stations of moderate capacity

THE type illustrated is made in standard capacities from 50 to 1100 kva., for operation on 240 to 2400 volt circuits. They will successfully carry commercial loads of low power factor.

No effort has been spared to produce machines which will insure to the purchaser the maximum returns on his investment. Moderate first cost, and consistently satisfactory service, are points the buyer will find it profitable to investigate.

Ask our nearest office to mail you a copy of circular No. 1190, it gives a fully illustrated description of these generators.

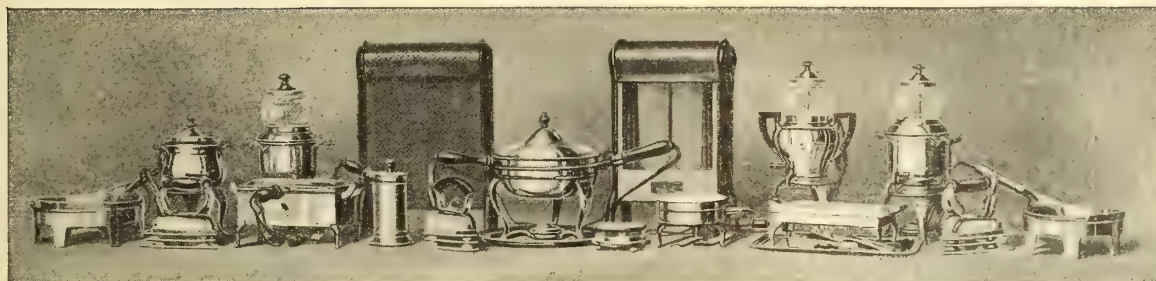
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Westinghouse

Electric Household Appliances

The Day Load Builders



Display Westinghouse Electric Household Devices in Your Store Window

Let the public see that you carry a line they have confidence in. They know the name and the quality it stands for.

The Central Station Manager who puts Westinghouse Devices on his lines knows they will stay put and be steady day load builders.

The Dealer who sells Westinghouse Devices makes satisfied customers who will advertise him among their friends as a reliable dealer.

Here is a List of Westinghouse Heating Appliances:

Electric Irons
Toaster Stoves
Coffee Percolators
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Chocolate Warmers
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Toronto	Montreal	Halifax	Winnipeg	Calgary	Vancouver
Traders Bank Bldg.	52 Victoria Square	Telephone Bldg.	158 Portage Ave. E.	311 8th Ave. W.	Bank of Ottawa Bldg.

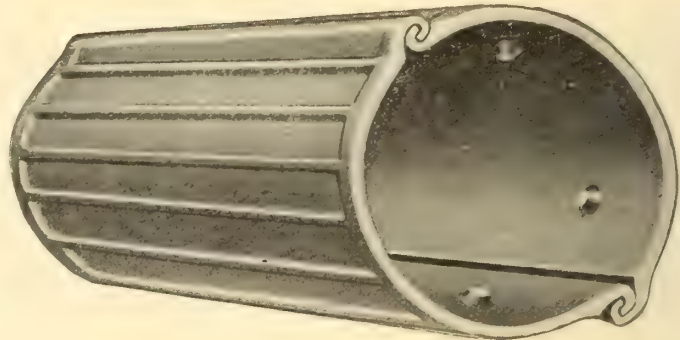
Indianapolis Brass Company

Conservation and Reclamation

is now the watchword of roads using iron poles.

There is one dangerous enemy to guard against in using iron poles—corrosion.

This (and more) is effectively taken care of with our Protective and Reclaiming



Patent Applied For

Pole Sleeve for Iron Poles



With this device installed on new construction, full protection is afforded against corrosion at the ground line which is sure to set up otherwise. Poles already installed that have weakened at the ground line can be restored to original strength by this sleeve which will give them three times the life of the original poles. The four projections on the inside of the sleeve afford ample clearance for filling with cement or other substances which will give bearing surface over the entire surface.

The self locking joints are slipped together from the ends making a perfect fitting sleeve.

Sleeves are of malleable iron, made for any size poles.

If you use iron poles write for full particulars on this money-saving device. (Mentioning this issue of the News).

INDIANAPOLIS BRASS COMPANY

924 Michigan Ave., Indianapolis, Ind., U.S.A.

Canadian Agents: C. H. L. Keeler Co., Toronto, Ontario

Indianapolis Brass Company

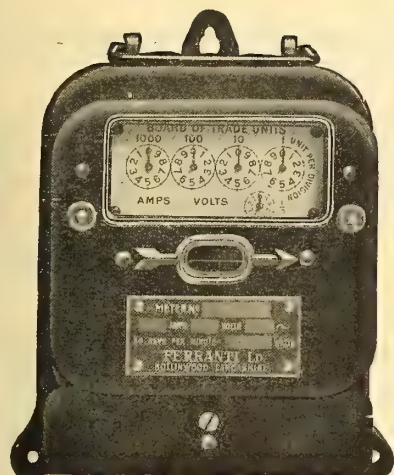
Indianapolis Brass Company

Indianapolis Brass Company

FERRANTI LIMITED

Electrical and General Engineers

**Manufacturers of Complete Switchboards, D.C. or A.C. up to 60,000 Volts,
Transformers, Meters, Auto Starters, Switches, Circuit Breakers, etc.**



Steel Case
Bottom Terminals

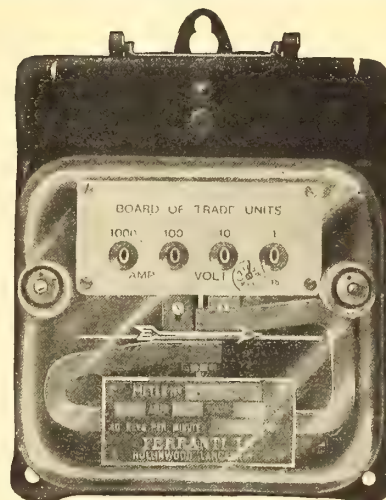
FERRANTI METERS

possess a World Wide
reputation for

Accuracy

Durability

Reliability



Glass Case
Top Terminals

The Ferranti New Type "C" Meter

This meter is an entirely new pattern which provides for the present day development of high electrical efficiency. It has been specially designed and constructed to meet the requirements of Canadian conditions and will be found one of the most satisfactory meters obtainable.

The Meter is of the induction type, accurately measuring the energy passed through it under all practical conditions on inductive or non-inductive loads, on overloads up to 50 per cent. It maintains its accuracy from full to one-twentieth load and is independent of fluctuations in pressure, changes of frequency, and variations in temperature.

Large clearances are provided for the coil windings to allow a high insulation resistance and suitable for working pressure up to 600 volts.

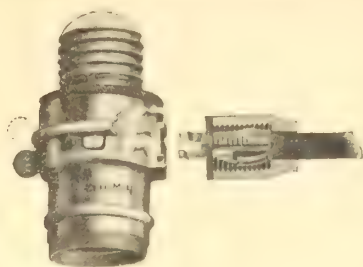
Independent adjustments may be made for full load, low load and inductive load. Adequate provision is made for ensuring the permanence of these adjustments.

All meters will stand a flash test of 1,000 volts alternating current, and are not affected by a short circuit through a fuse of double the capacity of the Meter.

**If you are in the market for Meters or any kind of Electrical Equipment,
send us your specifications and let us quote you.**

Canadian Representative:

GEORGE C. ROYCE, West Toronto, Ont.



Cat. No. 96
Separable Current Tap



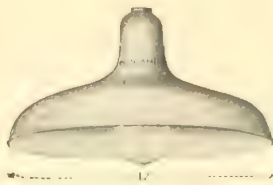
Cat. No. 67
Cleat Receptacle



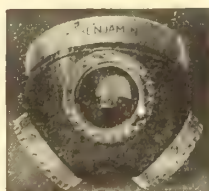
Cat. No. 42
Weatherproof Socket



Cat. No. 67
Sign Receptacle



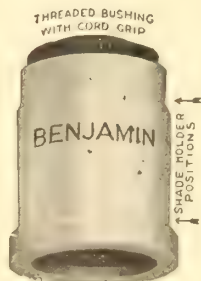
Bowl Type
Reflector Socket



Cat. No. 23
Wireless Cluster



Cat. No. 412
Twin Socket



Cat. No. 240
Cord Grip Drop Socket

BUY BENJAMIN SPECIALTIES

Originality
Simplicity
Quality

Benjamin Specialties enjoy the reputation of being the most widely used Electrical Devices in the Dominion of Canada and they have won this position by sheer force of merit.

"Benjamin" is Standard

Write for Catalog C-24

Benjamin Electrical

64 YORK ST.



Cat. No. T74



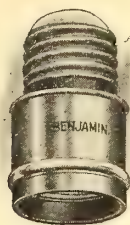
Cat. No. 1550
Gas-Proof Unit



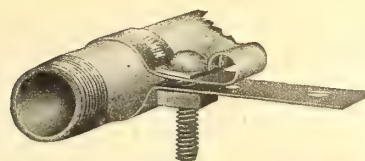
Cat. No. 92
Plug Cluster



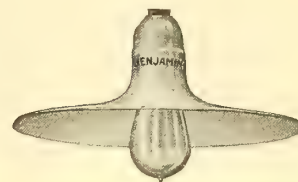
Cat. No. 98
Large Base Reducer



Cat. No. 41
Extension Plug



Cat. No. 1
Adjustable Ground Clamp



Flat Type
Reflector Socket

BENJAMIN L T I E S

every little detail of construction is
given the most careful attention: every
scheme of simplicity, dependabil-
ity, reliability is embodied in each de-
vice.

Electrical Devices

Write for Catalog C-20

Manufacturing Co.

ONTARIO

Dependability
Reliability
Delivery



Cat. No. 4200
Benco Socket



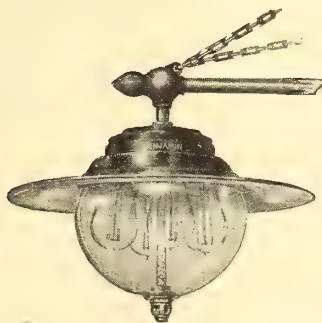
Cat. No. 69
500 watt Porcelain Socket
Large Base



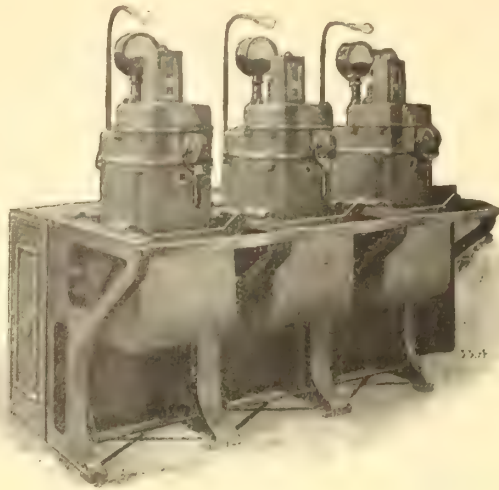
Cat. No. 903
Attachment Plug



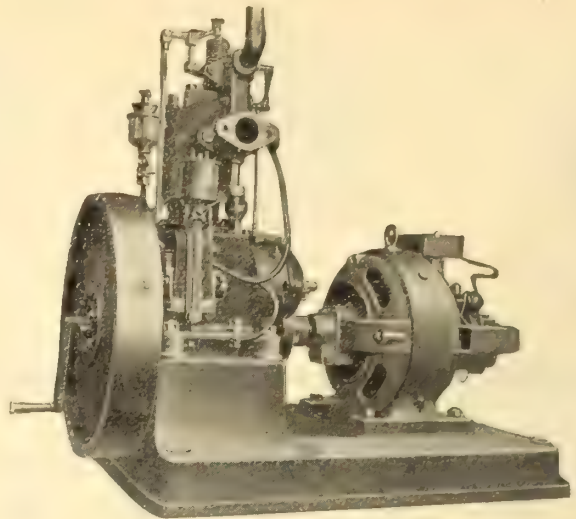
Cat. No. 4210
Large Base Socket



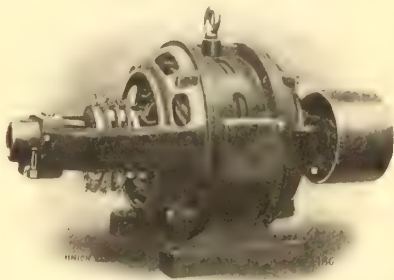
Cat. No. T714



High
tension
Switch
gear
Pull-out
system



Isolated generating plants
for petrol or paraffin fuel

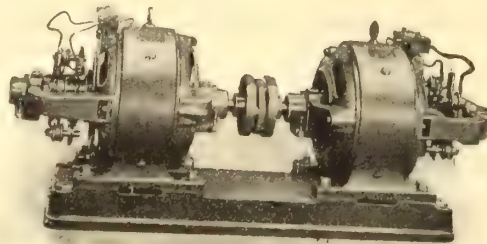


Single and
polyphase
Induction
Motors

CANADIAN UNION ELECTRIC CO LIMITED

9 St. Nicholas Street
MONTREAL

Motor - generators
D.C. to D.C.
or
A.C. to D.C.
for
moving-picture
work, etc.



Telegrams
Alladin
Montreal

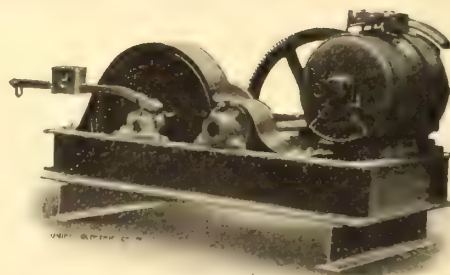
Telephone
Main
4204

We illustrate a few of our most successful types and applications of electric machinery.

Our control apparatus is designed to safeguard it's machinery and the man who operates it.

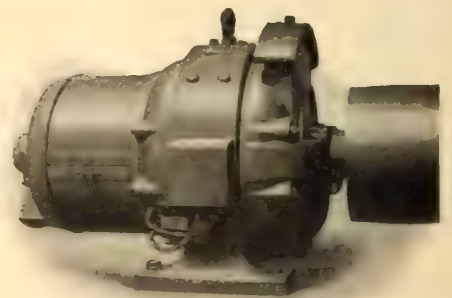
Our generators and motors are built to give a high efficiency and a long life without the necessity of repairs.

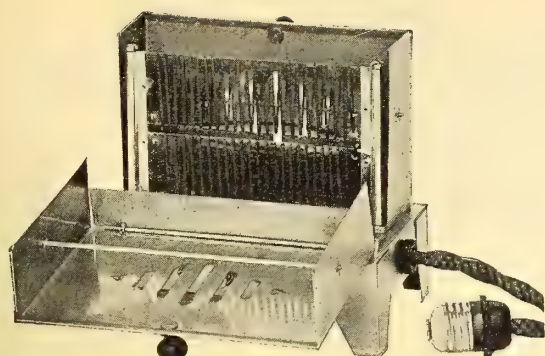
We guarantee everything we sell against faults attributable to bad work or material in manufacture and we stand up to our guarantee.



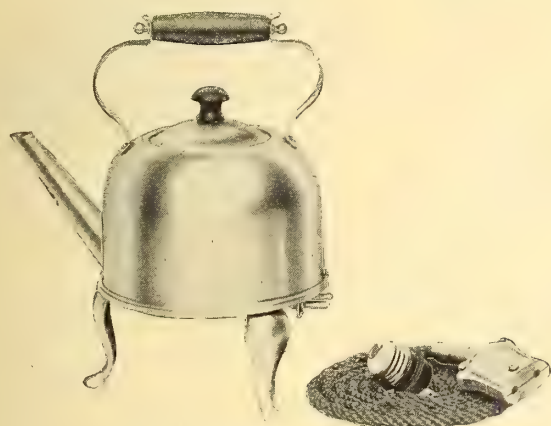
Motor driven
friction hoists
for D.C. or A.C.
circuits

D.C. Motors
with
Enclosed Ventilated
Covers

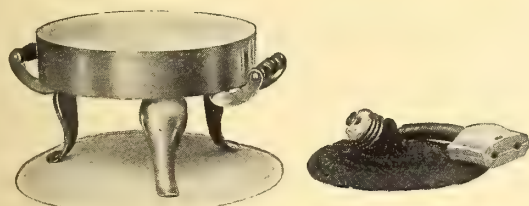


**Bread Toaster***"More Heat at Least Cost"*

The Bread Toaster is a beautifully finished utensil fit to put on any breakfast table.

**Tea Kettle***"No Alcohol—No Smell—No Danger."*

The Tea Kettle finds favor with all—men, women, business girls and bachelors—so convenient for the essential cup of tea.

**Disk Stove—Sizes 6 in. and 8 1-2 in.***"Hot—But Safe as Electric Light."*

The Disc Stove lends itself to greater utilities and will cook anything up to a small complete dinner. Made in several sizes.

"Radiant"

Electric Household Conveniences

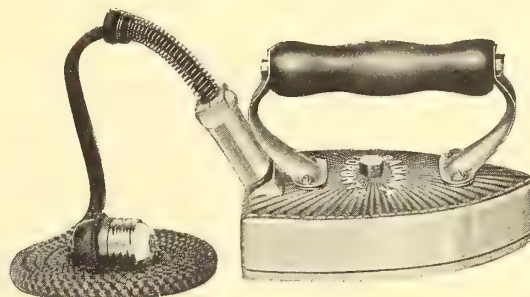
are recommended by all who use them—they are lightening the work and saving dirt, trouble and worry in thousands of homes. Wherever they are used they become the only make of electrical appliances that the users will purchase—they are the acknowledged favorites and their sales proclaim their popularity. "Radiant" Electrical Household Conveniences are so reliable, they never break or get out of order—they last so long and give the greatest satisfaction all the time—they are the sterling make. An iron is purchased as an experiment—it proves so successful that the purchaser comes back for the kettle and then the disc stove—always insisting on having goods of "Radiant" manufacture.

Write for our prices—we have a good horse-sense business proposition to put to any up-to-date dealer.

The Radiant Electric Manufacturing Co. Limited

GRIMSBY, ONT.

Toronto Office, Stair Bldg., Bay St.

**Domestic Sad Iron—5, 6 and 7 lbs.***"Nothing Hot but the Iron"*

The Domestic Sad Iron is the newest model and is a great improvement over older designs. All the heat is concentrated on the ironing surface, thus effecting great economy and efficiency.

Electric Supplies for Every Power Need



Three Phase Motor

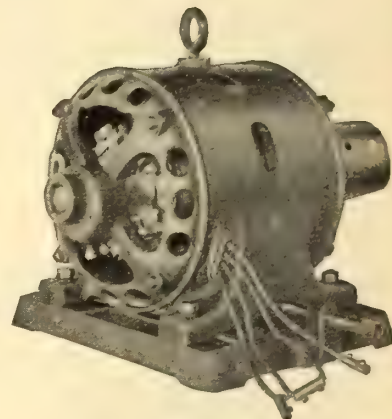
SELLING AGENTS FOR

Century

Single Phase
MOTORS

AND

"Century"
FANS



Single Phase Motor

Best in the World

We have the right motor for every use—where our motors are used they always bring a big saving because of their efficiency, reliability and economy of power. We can show you the most effective combinations in equipment to install in any electric service—money-saving ways of arranging existing conditions.

Motors

Alternating or Direct Current

Supplies

Dynamos

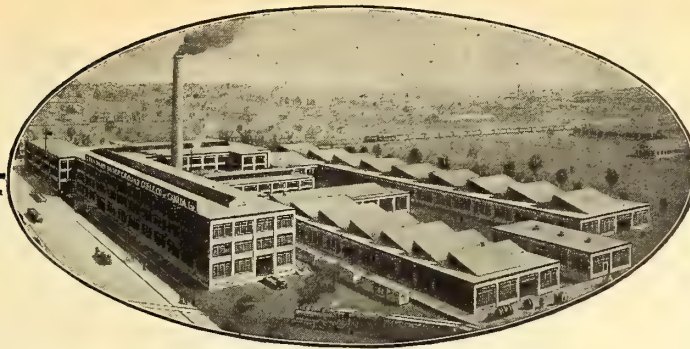
Belt or Direct Connection

Wires

WE HAVE SOLVED POWER PROBLEMS FOR THOUSANDS—LET US HELP YOU

Jones & Moore Electric Co., Limited

Factory and Head Office :: 294-300 Adelaide Street West, TORONTO, Ontario



Plant of Standard Underground Cable Co., of Canada, Ltd.,
Hamilton, Ont.

Standard Service

The Bare and Weatherproof Wire and Cable Departments of our Factory at Hamilton, Ont., are now in full operation, ready to meet your every requirement promptly.

A large number of important Light, Power and Railway Companies, Engineers, Architects, and Contractors throughout Canada have been specifying and buying STANDARD Products for years.

STANDARD Products have been for over 30 years and will always be, made and sold upon a Quality Basis. This means greater durability, greater safety and greater economy.

STANDARD Bare Wire is drawn from the best commercially pure wire-bars and meets the exacting requirements of many of the largest telephone, telegraph and street railway companies in the world.

STANDARD Weatherproof Wire and Cable is mechanically perfect in all respects, the insulation presenting a firm tough mass that will withstand extremes of heat and cold and rough usage.

STANDARD Service consists also in giving prompt replies to your inquiries, in filling and shipping orders carefully and quickly. We will gladly advise you regarding your installation problems. Please make full use of this service.

We will appreciate an opportunity to serve you and to show you that STANDARD Quality is always higher than STANDARD Prices.

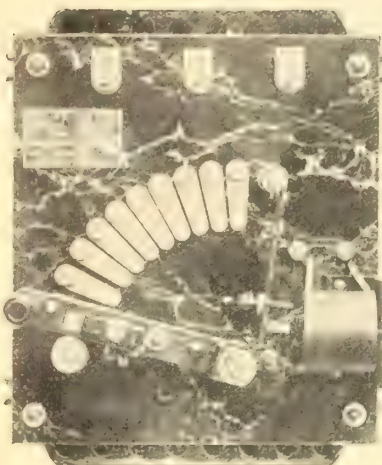
Send Us Your Inquiries

**Standard Underground Cable Co.,
of Canada, Ltd.**

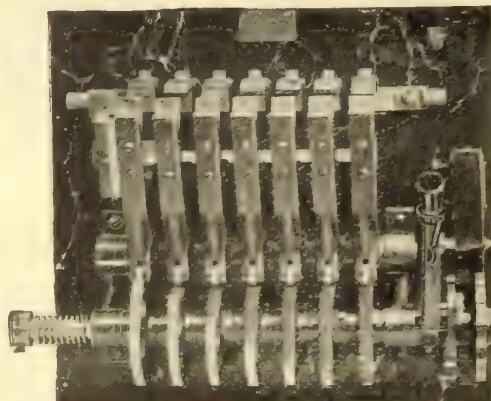
Department E Hamilton, Ont.

Manufacturers of Electric Wire and Cable of all kinds, all sizes, for all purposes, also Junction Boxes, Terminals, Insulating Compounds, etc.

CONTROLLERS

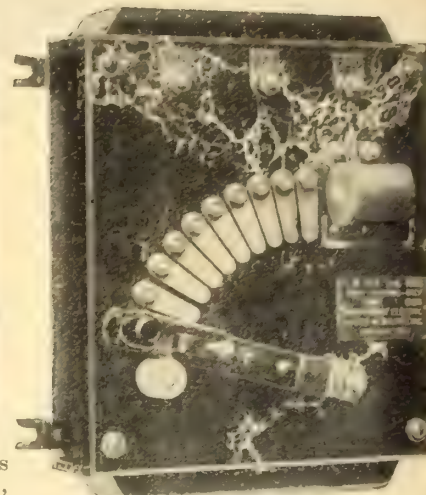


A Single Phase Starter with No-Voltage Release



D. C. Multiple Switch Type Speed Controller

Operated by a master lever, which controls all contact levers. All laminated copper brush, and parts are renewable and easily accessible.



D.C. Motor Starter, for All Around Service

The Words

Independent Control

are synonymous with

Reliability and Perfection

We manufacture the best starting and controlling devices that money and skill can build.

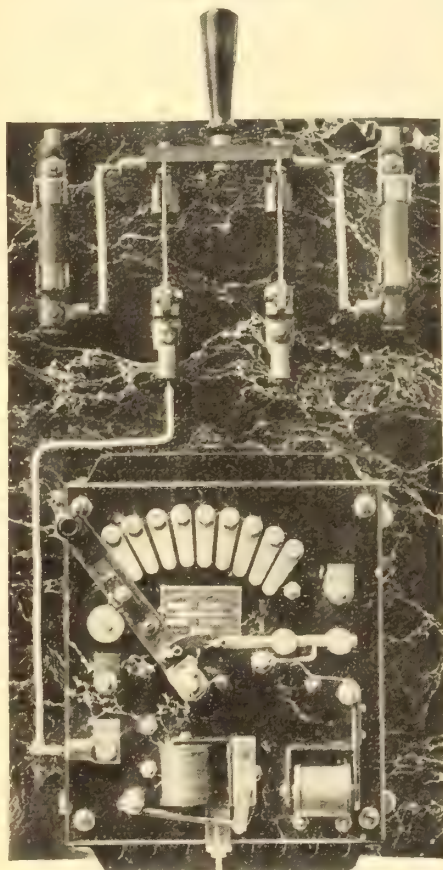
*Remember our Rheostats
are guaranteed*

May we send you our Catalog?

Every dealer and jobber should have one of our

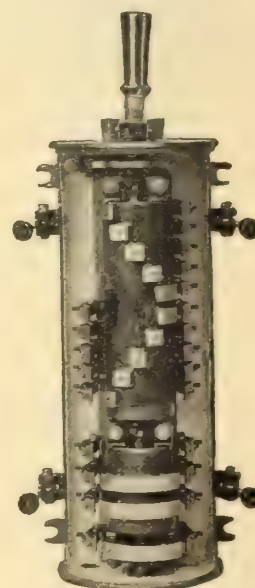
New 1912 Catalogues

Special bulletins will be sent to any individual desiring information.



D. C. "Universal" Controller

Has our newly patented improved horizontal ratchet bar, which insures accurate contact. This bar can be replaced at slight expense, a decided advantage over controllers requiring renewal of the entire lever when the ratchet becomes worn.



A. C. Reversible Slip Ring Type Drum Controller

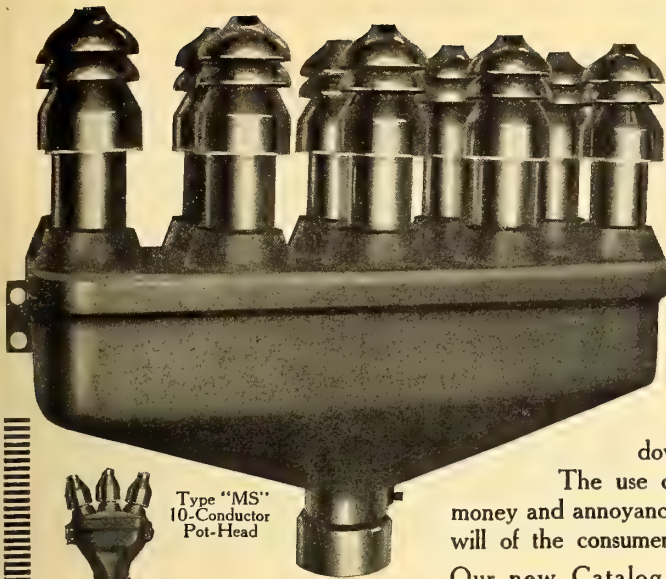
Compact, easily installed. Adapted for portable use and also for printing presses, cranes, hoists, machine tools, etc. One to 150 H.P.; 5 to 6 speeds. Built of gray iron castings. Renewable hard copper segments and phosphor bronze fingers. Resistance box separate.

Independent Elec. Mfg. Co.

Chicago Office & Warehouse:
160 North Fifth Street

Milwaukee, Wis., U.S.A.

Eastern Central Office:
39 Cortlandt Street, New York City



Type "MS"
10-Conductor
Pot-Head



Our new Catalog No. 7 contains many new devices embodying the well known G & W characteristics. Send for it.

G & W Electric Specialty Co.

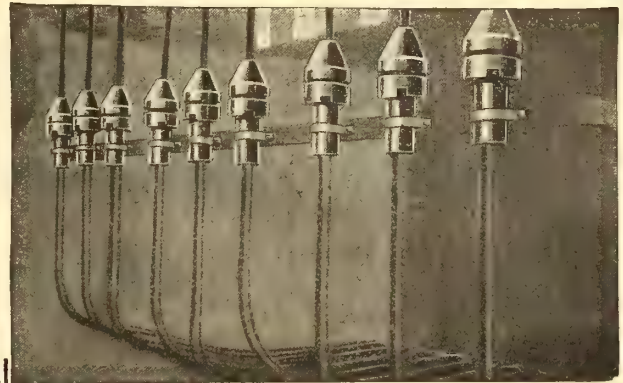
6408 Jackson Park Avenue
CHICAGO, U.S.A.



YOUR METERS WILL TURN LONGER

through the use of G & W Electric Devices. The above is true from the fact that the use of these devices reduces the time of locating trouble to a minimum, and makes the liability of breakdown very remote,—practically impossible.

The use of G & W Specialties will therefore save you time, money and annoyance, at the same time enabling you to retain the good will of the consumer by rendering efficient, uninterrupted service.



Heating With Exhaust Steam

The Most Profitable Load an Engine Carries

Many of you are manufacturing heat in the form of steam, but what becomes of it? You are simply converting 10 to 14 per cent. of it into mechanical energy in the form of electricity, and throwing the balance away, either into the atmosphere or into the condenser. The plant which operates non-condensing may have 10 per cent. heat efficiency and the condensing plant a possible 14 per cent. conversion.

Why Not Sell the Larger Amount of the Otherwise Lost Energy

You can get a price for it which will pay the total fuel bill of the plant, including also such other expenses as water, oil, etc.

CAN IT BE DONE? YES!

Others are not only doing that very thing, but are also earning interest and depreciation on the cost of the steam installation.

*We not only Make Reports and Build Central Station Plants,
but Solicit Business and Manage Such Plants, if Required.*

Why Not Take Advantage of Our Experience?

Central Station Heating & Construction Co.

714 Ellicott Square, BUFFALO, N. Y.

Canadian Office: W. E. SKINNER LIMITED, Somerset Building, WINNIPEG



The Approved Method of Connecting Track and Pavement

Before the advent of Nelsonville Filler and Stretcher Brick, common practice called for the use of the old style "Nose Brick"—one end under the ball of the rail, using long and short brick alternately to break joints.

It was a makeshift and caused no end of trouble until it was remedied with

**NELSONVILLE
FILLER AND STRETCHER
BRICK**

Any brick that does not fit the web of the rail is of no practical use. They will break and kick up.

Our filler and stretcher brick have been in successful use for over 7 years.

The filler brick fills the entire web of the rail and does away with the necessity of any other filler material.

The flanges of any car find ample accommodation within the groove formed by the filler and stretcher brick.

Wherever trial installations have been put in they have been approved by city engineers because they offer all the advantages and none of the disadvantages of the groove rail.

Write for our booklet, "Rail Brick of the Right Sort."

The Nelsonville Brick Company
Nelsonville, Ohio

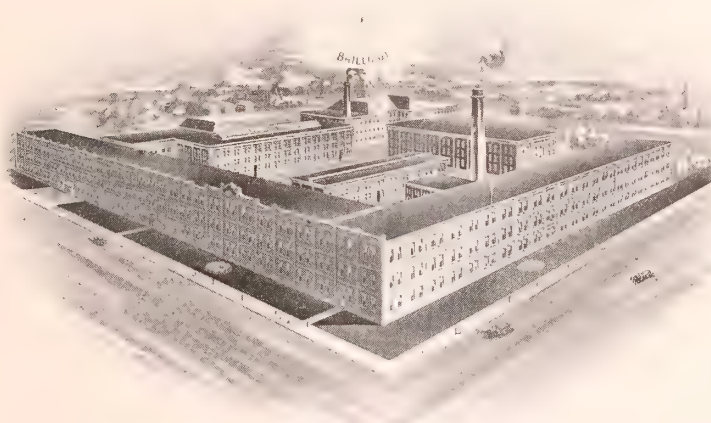
DRAWN-WIRE KOLLOID WOLFRAM TUNGSTEN LAMPS

Manufactured in a **Canadian Factory** employing **Canadian Workpeople**
and **Canadian Capital!**

A BETTER LAMP FOR LESS MONEY!

Whilst we are constantly improving our Lamps we are also consistently reducing prices!

Any
and Every
Type



At
Shortest of
Notice

The First Tungsten Lamp Sold in Canada
and
The Tungsten Lamp with the Largest Sales To-day

The Canadian Tungsten Lamp Company

Lighting Experts

Limited

Hamilton - - - Ontario

Electric Glass Shades!

Tiffanies! Venetian! Decorated!

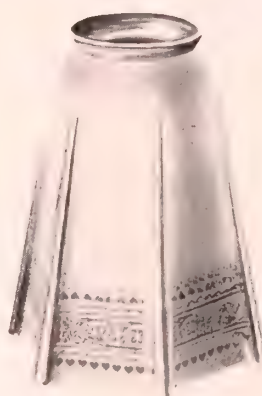
Alabaster! Etched and

Cheap Lines!!!



X115

Beautiful Shade, Tiffany
Colouring
Very low price



X97

Crystal Manographie
Graceful lines



X96

Frosted with clear
decoration



X191

Crystal Etched
New designs

High-Class Goods are a
perpetual advertisement
for YOU and show you
much better profits.

*Dutch
Design
Suitable
for
Cosy
Corners
Etc.*



X190

The Canadian Tungsten Lamp Company

Lighting Experts

Limited

Hamilton - - - Ontario

Electric Glass Shades!

Green Cones! Half Shades!

Billiard Shades!

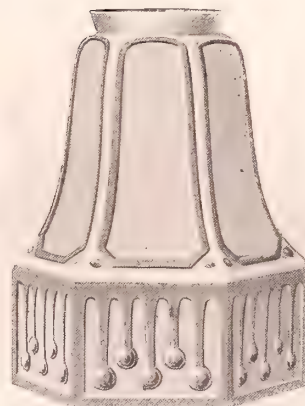
Cut Star Balls! Etc.!!



X167
Soft Harmonious Colours
Very artistic

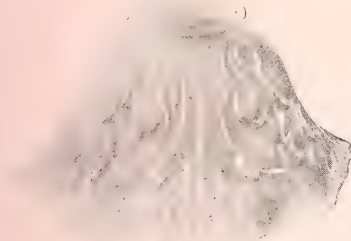


X193
Frosted Sheffield
Very low price



X86
Frosted with clear decorations

Prompt
Shipments from
Stock!



Venetian
for
Soft Mellow
Light

X35



Rich
Tiffany

X170



X43
Etched with Dainty
Colouring

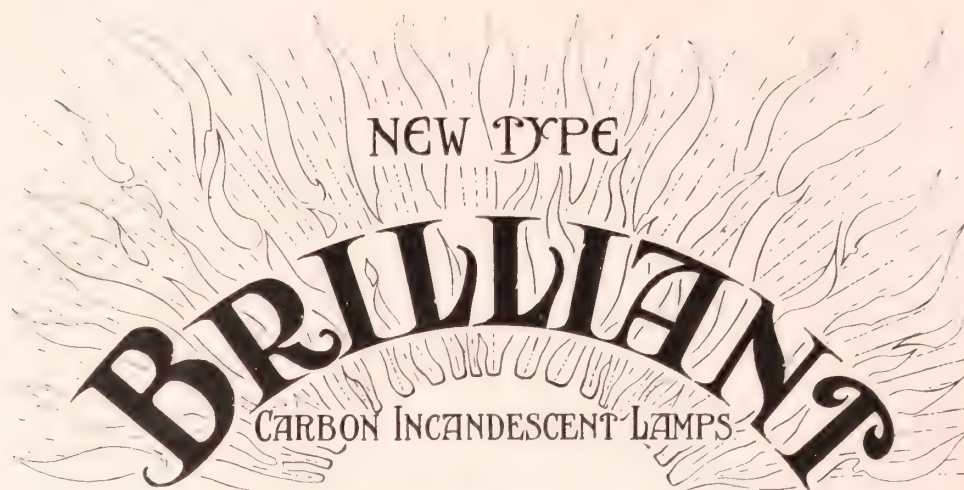
Silk Flex, Silk Counterweight Cord,
Two and Three Way Tumbler
Switches, Shock Absorbers, Etc.

The Canadian Tungsten Lamp Company

Lighting Experts

Limited

Hamilton - - - Ontario



**Only Experienced Hands
and Selected Materials**

**Superior Efficiency
Long Life and
Exceptional Finish**

PROMPT DELIVERIES!



**When we satisfy the
PRINCIPAL RAILROADS
JOBBER
POWER HOUSES
HYDRO
COMMISSIONERS
and others, surely we can
please you!!**

All Kinds of Miniature Lamps, also Spherical and Tubular

Tungsten Automobile Lamps that withstand hard usage.

BRANCHES:

MONTREAL—30 St. Dizier St., J. W. Moncur, Manager. WINNIPEG—56 Albert St., A. L. Woolf, Manager.
TORONTO—312 Yonge St., L. E. Harp, Manager.

AGENCIES:

VANCOUVER—606 Granville St. NEWFOUNDLAND—St. Johns, Walter Clouston.
NEW BRUNSWICK—St. John, J. McAvity & Sons. VICTORIA, B.C.—911 Government St.
QUEBEC, P.Q.—Mechanics Supply Company

The Canadian Tungsten Lamp Company
Lighting Experts Limited
Hamilton - - - Ontario

The certainty of success and profit this line offers you;

the prestige it adds to your firm name, by identifying you as advocates of up-to-date lighting methods; the desirable class of trade it attracts to your doors, trade whose patronage insures your greatest success; all this is best shown by the tremendous strides dealers and jobbers are making in handling the EYE COMFORT System of Indirect Illumination.

There was not a single installation in Winnipeg when the De Cew Company started business with the EYE COMFORT System two years ago. To-day—in two short years—there are over **850 separate installations** in the city of Winnipeg alone, an average of **425 per year** for the first two years in business. Every kind of interior has been equipped,

Residence	Store	Club
Church	Office	Hotel
Theatre	Bank	Library
Hospital	Salesroom	School

As you see, the business is easy to get. Then also, an unsatisfactory installation is impossible. Every prospective job is first Engineered by us for you without any cost or obligation to buy. We maintain a staff of competent Illuminating Engineers (five times as large as last year) whose entire time is occupied in carefully compiling these Engineering Reports.

Surely there is some interior in your city of which you can send us a sketch showing the number and location of electric outlets, its height, length and width and a general idea of the color scheme, on which we may submit you a report.

Our Correspondence Department is entirely at your service to help you land the business.

We publish a handsome loose leaf Book. It covers the subject of correct Indirect Illumination and its Appliances; also efficient Show Window Lighting, most fully. It is instructive and worth having. May we send your copy?



We are the Originators and Sole Producers of

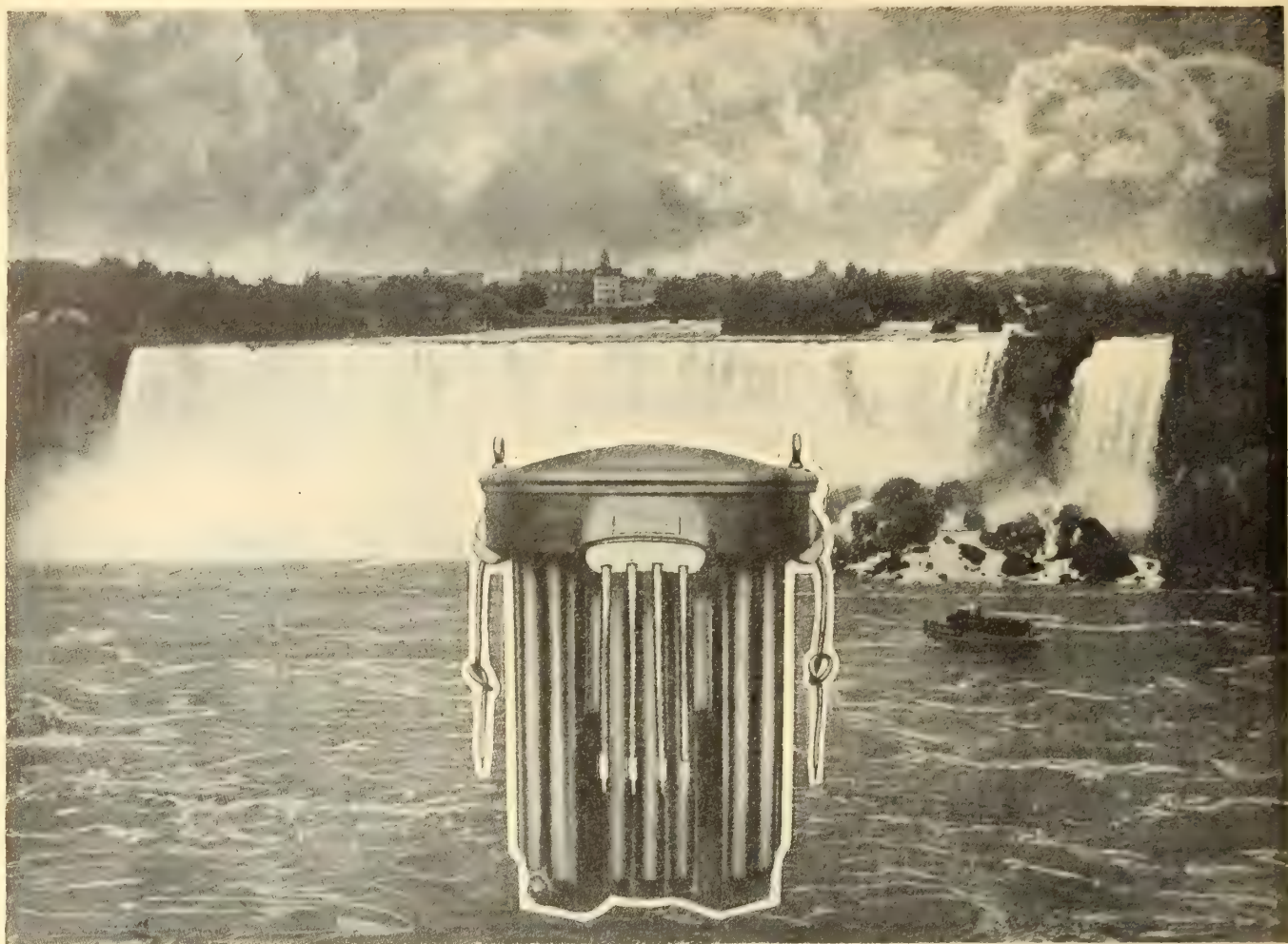
The EYE COMFORT System of Indirect Illumination

ALSO

X-RAY REFLECTORS—the most powerful made

NATIONAL X-RAY REFLECTOR CO.

214 W. Jackson Boulevard
CHICAGO, ILL.



The Total Power of Niagara

if converted into electrical energy could be transformed by the Type H Distributing Transformers in service today.

Reliability, proven by thousands of installations covering a period of over fifteen years, is one reason why Type "H" Transformers are used by the majority of central stations.

Type "H" losses in service are invariably better than Type "H" claims. Service proves the excellence of the Type "H" Transformer.

BUILT FOR LONG LIFE SERVICE.

Canadian General Electric Co.

Head Office, Toronto

Limited

Montreal

Halifax

Ottawa

Cobalt

Winnipeg

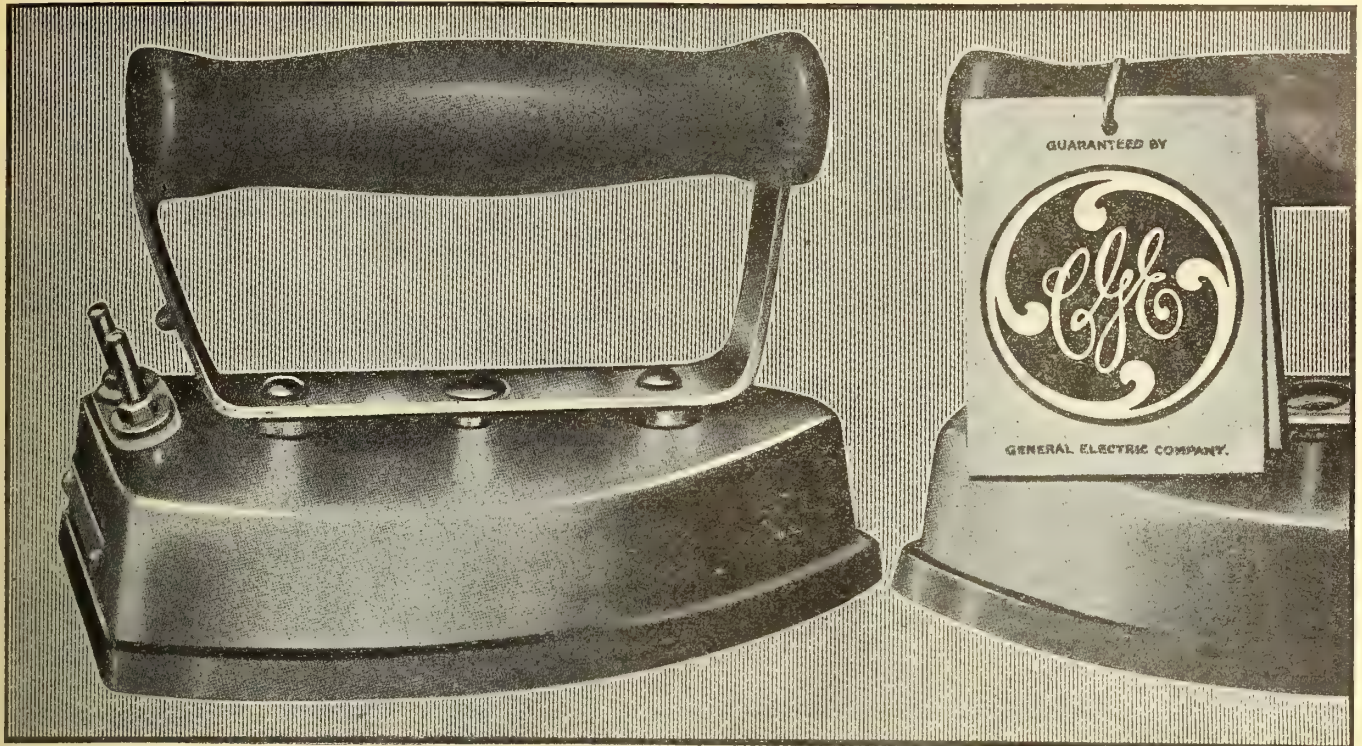
Calgary

Vancouver

Nelson

Prince Rupert

South Porcupine



The 1912 Model of Guaranteed Excellence

This new model is simply a refinement of our previous model acknowledged as the standard flatiron of 1911.

In engineering design, mechanical finish, simplicity and strength of construction, the 1912 C-G-E Iron maintains its leadership.

The C-G-E trademark is its guarantee of excellence. In addition, the Calorite heating unit is formally guaranteed for five years.

Your most careful examination and severest tests will convince you that the new C-G-E Iron is the one for you to standardize for this year's business.

Canadian General Electric Co.

Head Office, Toronto

Limited

Montreal

Halifax

Ottawa

Cobalt

Winnipeg

Calgary

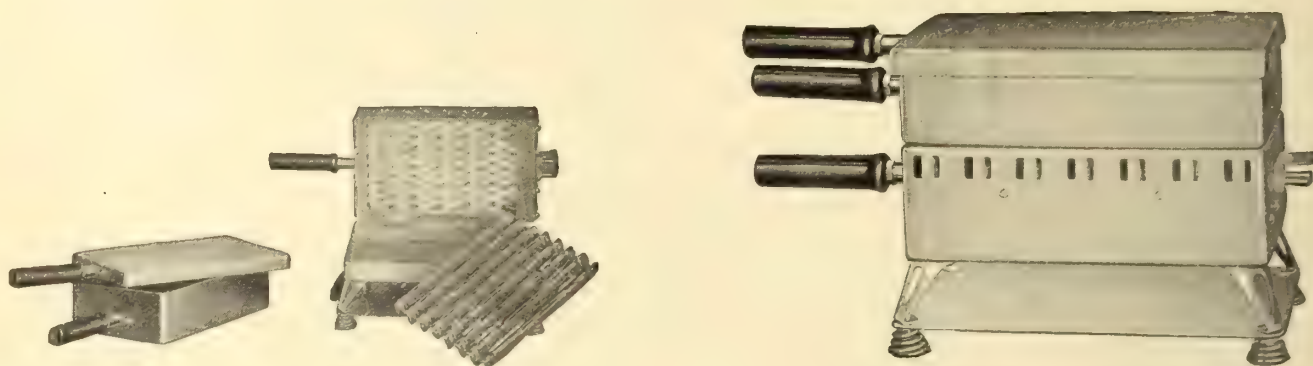
Vancouver

Nelson

Prince Rupert

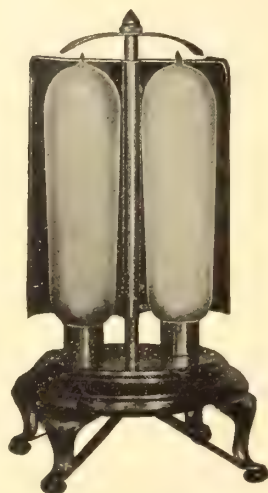
South Porcupine

New Ideas in Heating and Cooking Appliances



The New Radiant Grill—a combination device that grills as well as fries, toasts and boils—right on the table. The Radiant Grill bids well to rival in popularity the Radiant Toaster.

New Models of Luminous Radiators



Cat. No. 78871
Twin Glower Type



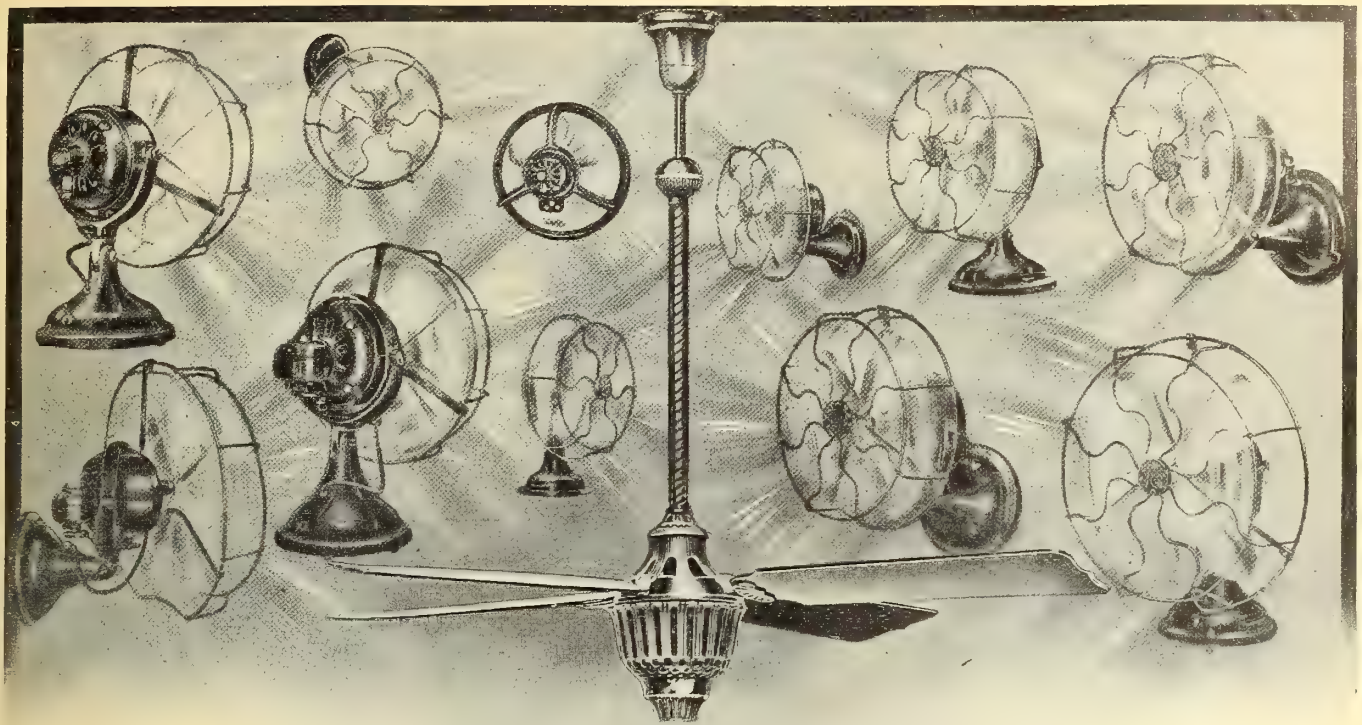
Cat. No. 78903
Grecian Style

No other type of Radiator combines heat with attractiveness as does the Luminous Radiators. For Nursery, Sick Room and Bath Room it is especially useful.

Canadian General Electric Co., Limited

Head Office, TORONTO

Montreal Halifax Ottawa Cobalt Winnipeg Calgary Vancouver Nelson
 Prince Rupert South Porcupine



Superior Design

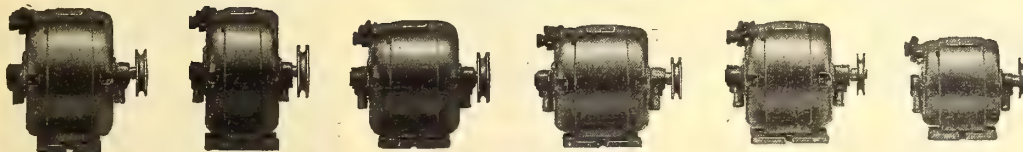


Reliability

Electric Fans for 1912

Complete in all standard styles and sizes, both alternating and direct current, for all residence and commercial uses. Stocks on hand at all branch offices.

SMALL POWER MOTORS



C. G. E. Drawn Shell Small Power Motors are unique in the simplicity and compactness of their design. Hundreds of them are in daily use giving perfect service under a wide variety of conditions.

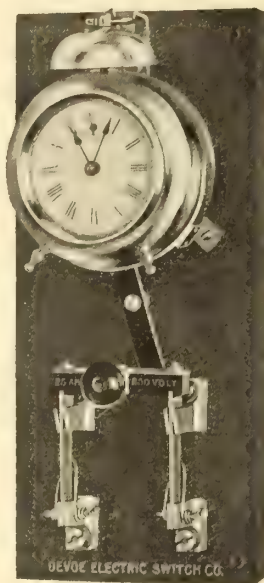
Canadian General Electric Co., Limited

Head Office, TORONTO

Montreal	Halifax	Ottawa	Cobalt	Winnipeg	Calgary	Vancouver	Nelson
		Prince Rupert		South Porcupine			

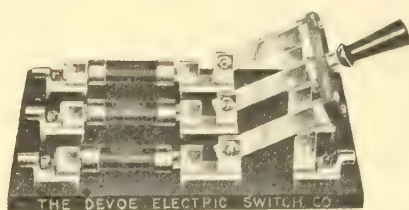
"Devoe" Means Quality

An Examination of
"Devoe" Standard
 Panels, Switches
 and Switchboards
 will convince you
 they are the best
 made.

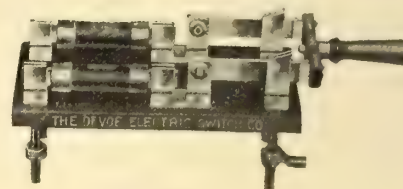


Type "A"

Every **"Devoe"** pro-
 duct is built for
 efficient service
 under actual operat-
 ing conditions.

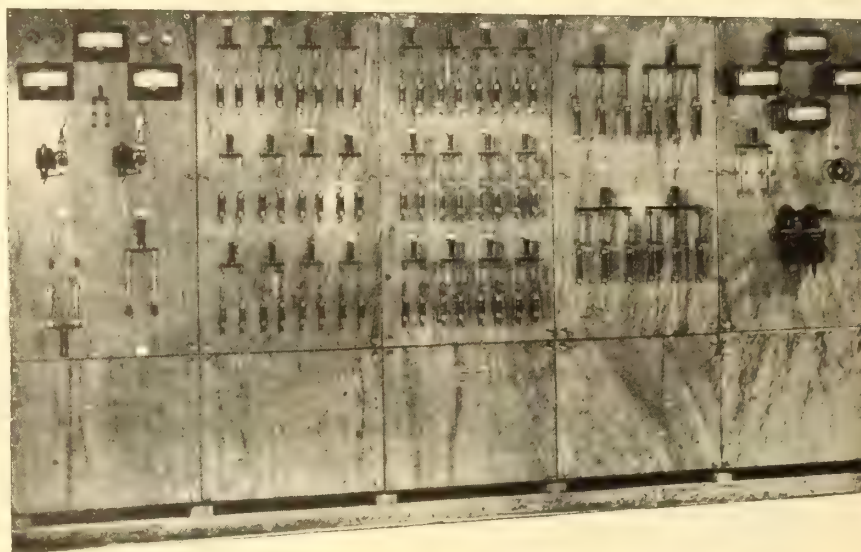


Cut No. 343



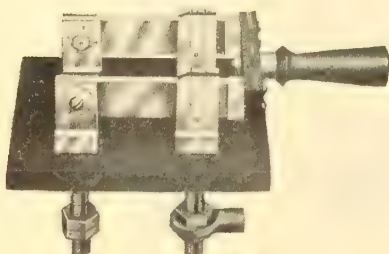
Cut No. 2005

PANELS,
 SWITCHES,
 SWITCH-
 BOARDS
 built to
 any
 specific-
 ation.



When
 specifying
 insist on
"Devoe"
 PANELS,
 SWITCHES
 and
 SWITCH-
 BOARDS.

"WE SPECIALIZE IN SWITCH BOARDS"

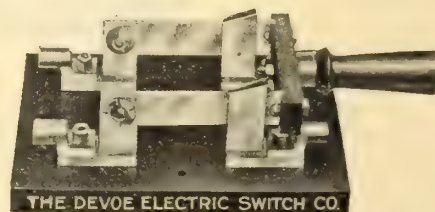


Cut No. 268

The
**Devoe Electric
 Switch
 Company**



"Devoe" Form Box



Cut No. 205

Office and Factory:
 157 Craig Street West,
Montreal, Que.

Walpole Rubber Company

Standards for Insulation

Neponset Splicing Compound or Pure Rubber Tape

Adopted as standard by the largest electric light companies. Toughness, strength and adhesiveness unexcelled. Insulating qualities equal to those of the best original coverings. Possessing greatest mechanical and dielectric strength, it maintains the insulation on circuits subject to high potential. Durable even under most destructive conditions. An absolute protection against short-circuiting and grounding. We welcome competitive tests regardless of the price.

Neponset Tape

The Standard friction tape meets all the requirements of the electrical trade. Fulfills the specifications of the U. S. Government. The fabric does not deteriorate with age. The friction is smooth and without pinholes. Will not deteriorate in any climate if left in package one year. Yards 180 feet to the pound, $\frac{3}{4}$ inch wide. Put up in $\frac{1}{2}$ -pound packages.

No. 45 Insulating and Filling Compound

Used in filling junction boxes, conduits, pot-heads or any underground system from central or sub-station where insulation and water-proof qualities are essential. Acid proof and water-proof. Plastic at zero temperature. Melting point to suit specifications.

Armalac

The standard insulating compound for armatures and field coils. Absolutely impervious to moisture. Made of black paraffine wax rendered permanently plastic by a process known only to this company. Is plastic whenever the machine is in operation. Without a trace of acid. Oil cannot affect the insulation. It has stood most severe tests in actual service for over 17 years.

Enamelac

The standard black paint for mouldings, junction boxes, controller and transformer cases, battery boxes, hot steam pipes, connections, etc. Glossy, quick-drying. Has no disagreeable odor. Not affected by battery acid fumes. Can be applied readily to dirty surfaces, hot pipes and boiler fronts.

For anything in rubber or liquid insulation, address

Walpole Rubber Co., Limited

Montreal, P.Q.

Owners of

Walpole Rubber Works

Walpole Varnish Works

Electric Insulation Laboratory

American Company: Massachusetts Chemical Co., Walpole, Mass.

Nearly Every Street Railway in Canada is Equipped with
Specialties made by this Company



IDEAL TROLLEY CATCHER

For City Service



PEERLESS ROLLER BEARING BASE

For Interurban Cars

STAR ROLLER BEARING BASE

For City Cars



KNUTSON No. 5 RETRIEVER

For Interurban Cars



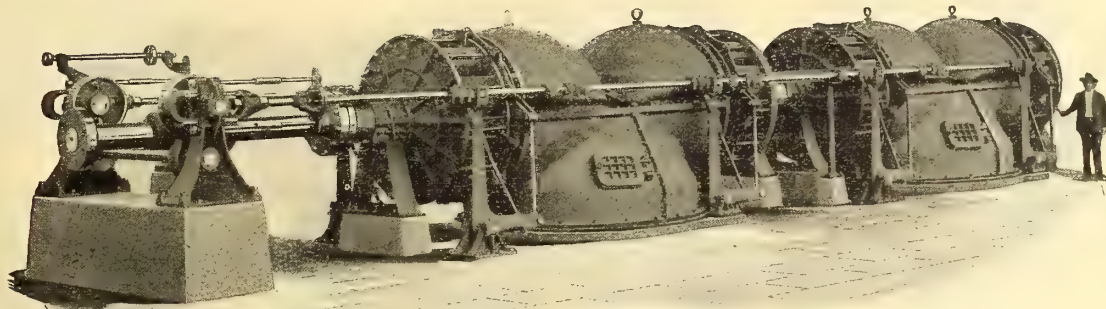
PEERLESS Jr. HEADLIGHT

In both Combination, Incandescence and Plain Arc

All types of Incandescent Headlights

The Trolley Supply Company
Canton, Ohio, U.S.A.

Hydraulic Turbines

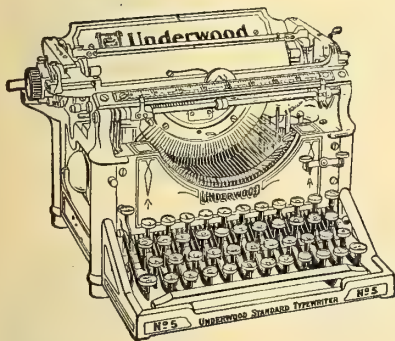


One Unit of Turbines of 3,200 H. P. 30' Head Furnished J. R. BOOTH, Ottawa, Canada.

Turbines Furnished for Heads from 5 feet to 600 feet

S. MORGAN SMITH, York, Pa.

BRANCH OFFICES: 167 Federal Street, BOSTON, MASS.; American Trust Building, CHICAGO.



Let This Sink In —

In every city in Canada the Underwood is used more generally than any other typewriter—in many places more generally than all other makes combined.

Why this pronounced preference for the Underwood ?

The Underwood is not a cheap typewriter—in fact, it costs a little more than others. But people do not buy the Underwood on a price basis. They buy it not for what it *is*, but for what it *does*.

THE Underwood does more.

—for bookkeeping, for order systems, for billing systems, check systems—for every kind of accounting, recording and statistical work, there is a special-purpose Underwood. And the system, designed for your particular needs and which is made possible by the Underwood, is worth many times the price of the machine. This system service costs you nothing. You can't get it with any other machine at any price.

United Typewriter Co. Ltd.
Everywhere in Canada



Pictures of a few fittings you should use



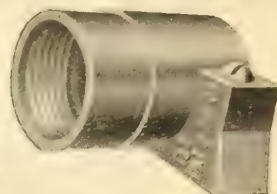
Hood Panel Connector



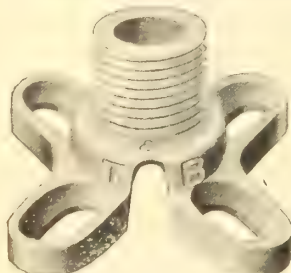
Hood Connector



Angle Hood Connector



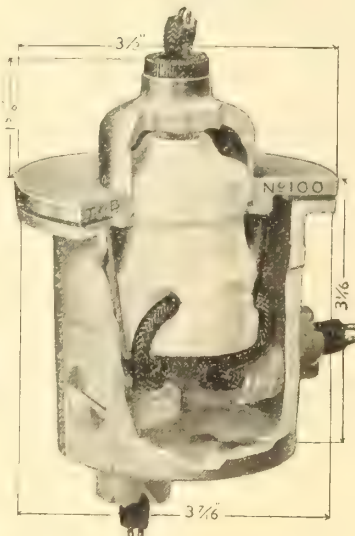
Hood Combination Coupling



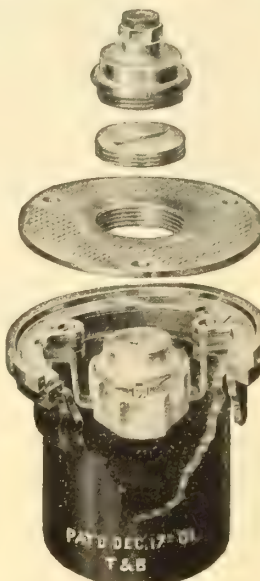
Hickey Fixture Stud



Fixture Stud



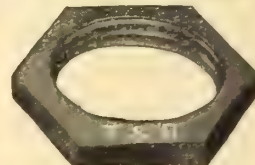
Floor Box No. 100



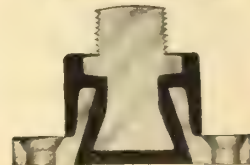
Stahley Floor Box



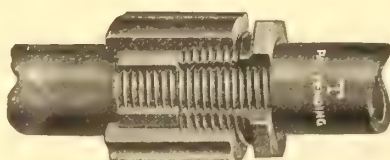
"T & B" Bushing



"T & B" Lock Nut



Insulating Stud



Erickson Coupling



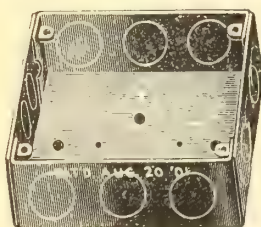
Split Steel Coupling



Conduit Hanger



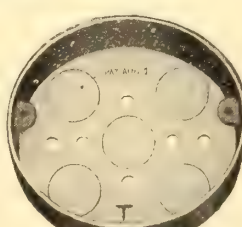
Chase Nipple



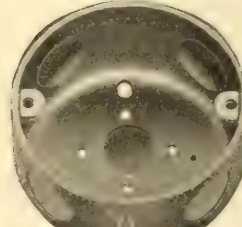
4 in. No. 300 Steel Box



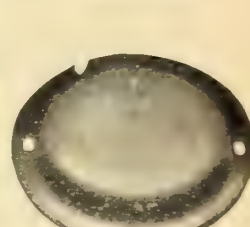
4 in. No. 9 Steel Box



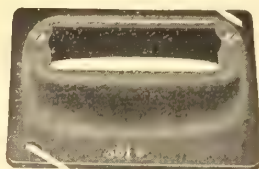
No. 5-S Ceiling Box



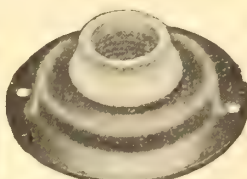
3 in. No. 7 Steel Box



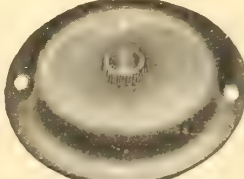
No. 7-A Cover



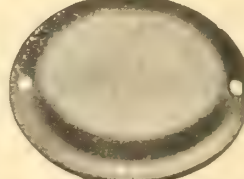
No. 301 S Cover



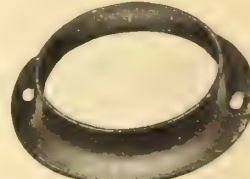
No. 9 F S Cover



No. 9 A S Cover



No. 9 S Cover



No. 9 E S Cover

Carried in stock by the best Canadian jobbers

THOMAS & BETTS COMPANY

299 Broadway
NEW YORK CITY

THE STEEL COMPANY OF CANADA LIMITED



BARE Copper Wire, Copper Trolley Wire, Copper Cable, Galvanized Telegraph and Telephone Wire, Galvanized Strand Wire, Guy Wires, Cross Arm Braces, Machine Bolts, Pole Steps, Square and Round Washers, Through Bolts—Plain and Hot Galvanized, Wood Screws, Wire Nails, etc.

WE INVITE ENQUIRIES FOR

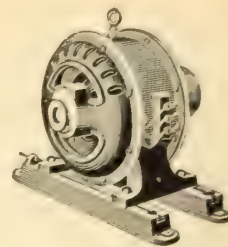
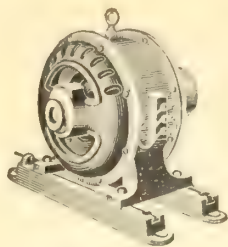
Telegraph and Telephone Circuits
Electrical Construction Work
Trolley Systems

LOWEST PRICES

PROMPT SHIPMENTS

DISTRICT SALES OFFICES

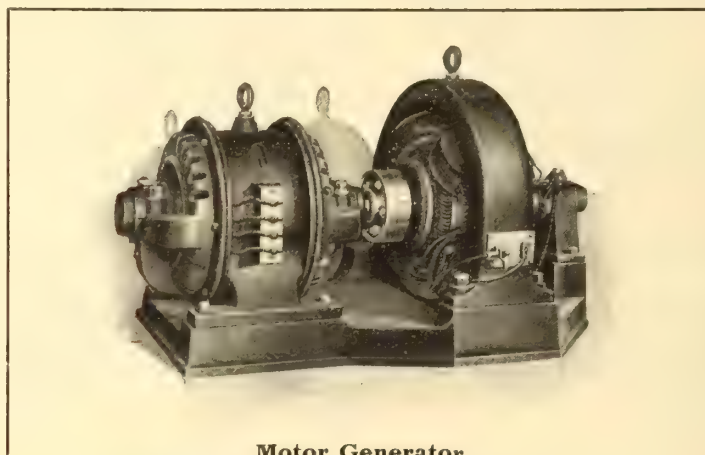
HAMILTON	TORONTO	MONTREAL	WINNIPEG
VANCOUVER, B.C.	VICTORIA, B.C.	ST. JOHN, N.B.	
	HALIFAX, N.S.		



Do You Want

High Class Electrical Machinery

at Reasonable Prices

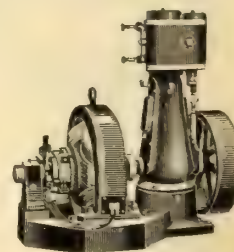
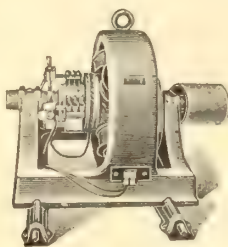


Motor Generator

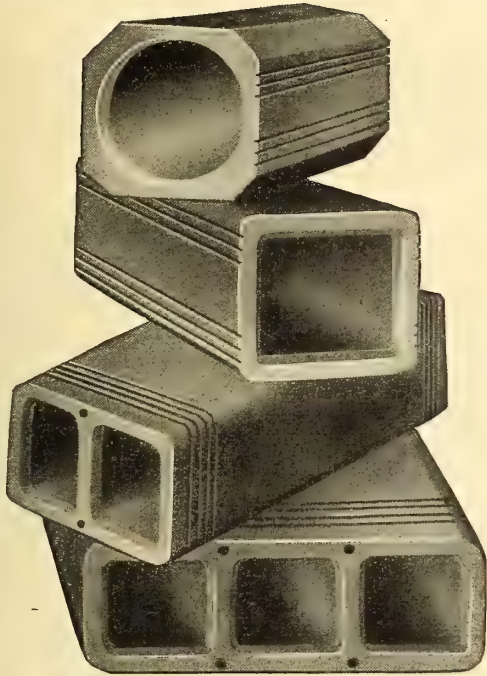
If so, write to

Toronto & Hamilton Electric Co.
Hamilton

Manufacturers of Electrical Apparatus
for All Circuits



CLERMONT DUCT

INDEPENDENT**PROGRESSIVE****COMPETITIVE**

Nearest Plant to Canada

Finest Conduit in the World

Plant Capacity
10,000,000 Feet Annually

Ask

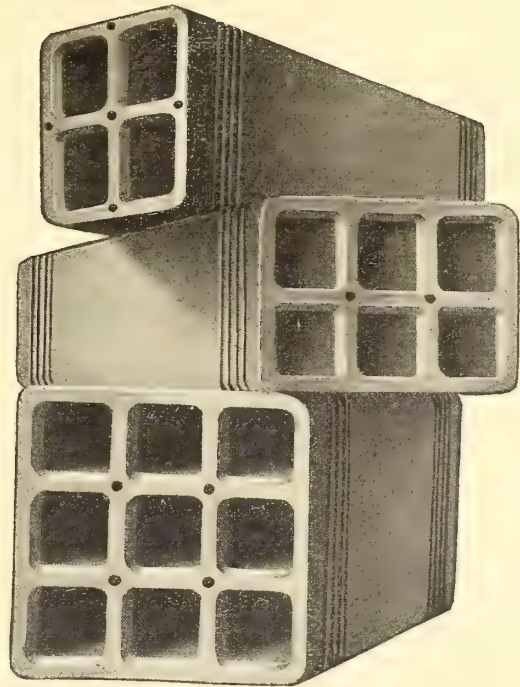
Canadian Bell Telephone Co.

Montreal Light, Heat and Power Co.

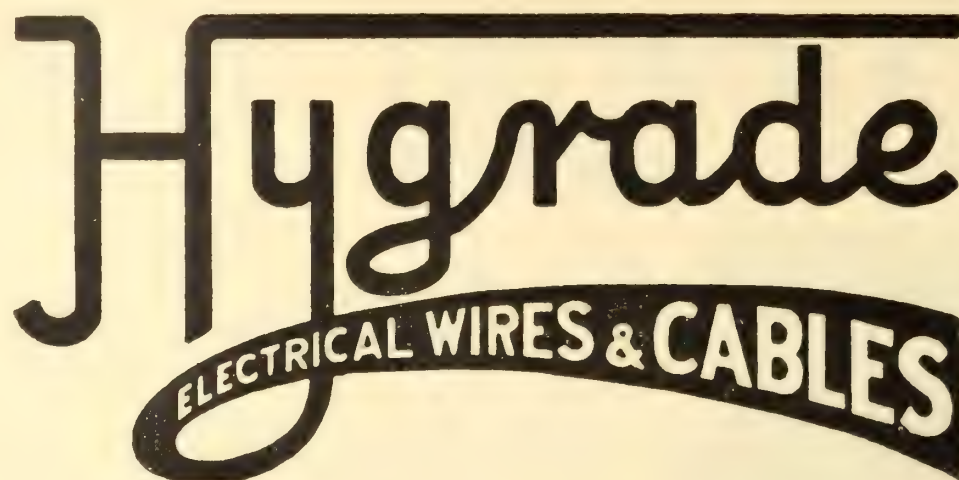
Toronto Electric Light Co.

City of Hamilton Hydro Electric Com.

and others



CLERMONT SEWER PIPE COMPANY
50 CHURCH STREET - - - - NEW YORK



Copper Aluminum Iron

Weatherproof Insulated and Bare

For
Telegraph, Telephone, Lighting
Power and Street Railway Circuits

Galvanized Steel Strand for Guys

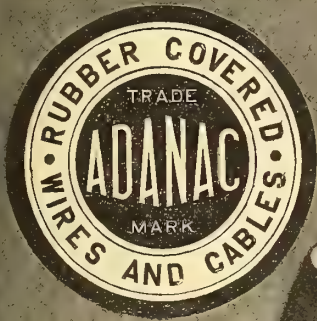
Canada Wire & Cable Co.

Limited

Eastern Sales Office and Warehouse
Roper Clarke & Co., Limited
422 Coristine Building, MONTREAL

Head Office and Factory
1160-1170 Dundas Street
TORONTO

ADANAC Red Core Rubber Covered WIRES & CABLES



Adanac Red Core Rubber Covered Wires and Cables

are made according to the specifications of the National Board of Fire Underwriters. The conductors are drawn from copper of the highest conductivity and are covered with two thicknesses of thoroughly vulcanized rubber compound of high quality. The wires are braided over insulation and the smooth high finish they receive makes them specially desirable for conduit work.

IMPERIAL WIRE & CABLE COMPANY Limited MONTREAL

THE *Northern Electric*
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SALES AGENTS

TORONTO WINNIPEG
REGINA
CALGARY VANCOUVER



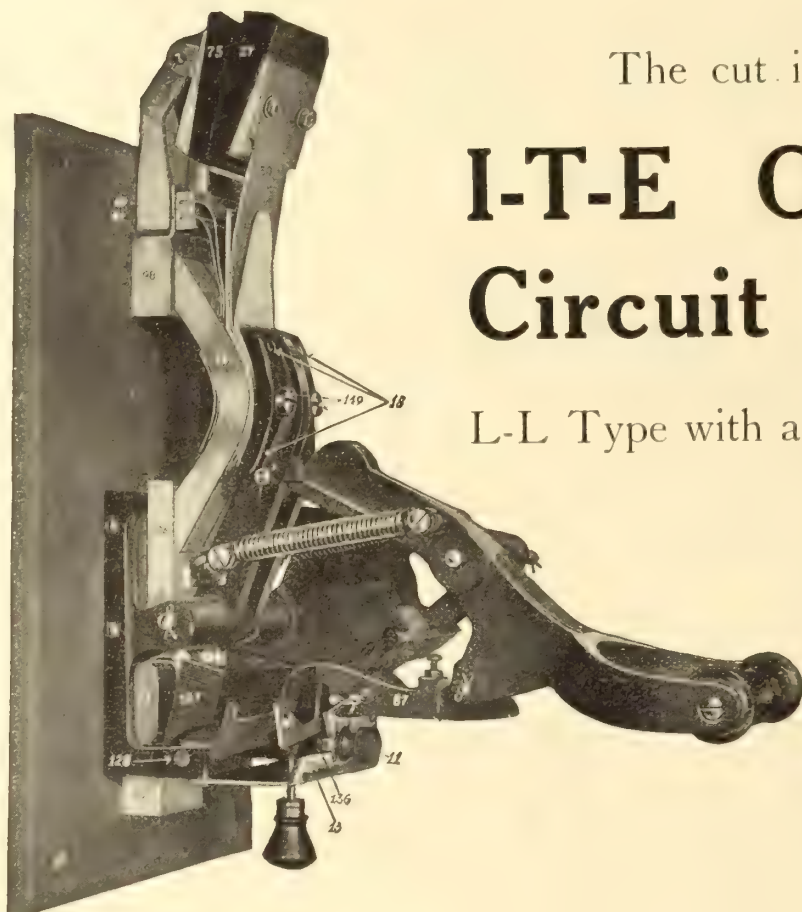
Perhaps no one piece of electrical apparatus is more widely used than the I-T-E Circuit Breaker. Certainly none has a higher reputation for effectiveness and reliability.



The cut illustrates an

I-T-E Overload Circuit Breaker

L-L Type with a part of the housing removed, showing the admirable simplicity of the working parts.



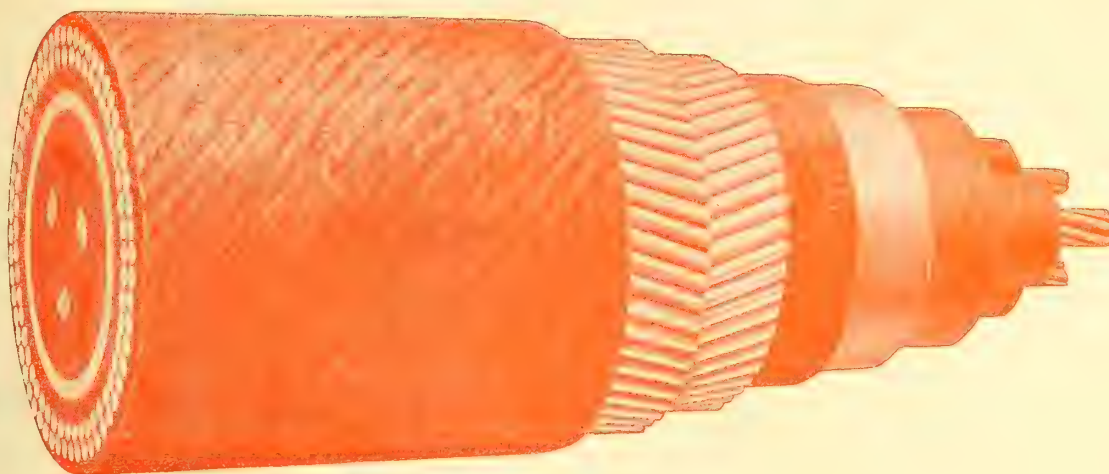
For more detailed information as to this and other types of I-T-E Circuit Breakers see the new I-T-E CIRCUIT BREAKER HAND BOOK.

THE CUTTER COMPANY, Main Office and Factory PHILADELPHIA

W. C. Jessup, 120 Liberty Street, New York City.
H. F. Darby, Jr., 1555 Monadnock Block, Chicago, Ill.
H. W. MacVaugh, 1122 Park Building, Pittsburgh, Pa.
Thos. E. Beasley, 751 Ellicott Square, Buffalo, N.Y.
C. E. Wise, 427 Ford Building, Detroit, Mich.
Eccles & Smith Co., 71 First Street, San Francisco, Cal.
Eccles & Smith Co., 524 S. Los Angeles St., Los Angeles, Cal.
Eccles & Smith Co., 68 First Street, Portland, Ore.
Electric Manufacturers' Sales Co., Tramway Bldg., Denver, Col.
I-T-E Electric Co., 72 Finsbury Pavement E.C., London, Eng.



The Cable across the St. Lawrence River from Pt. Aux Tremble to King Edward Park



The longest paper insulated Sub-marine Power Cable on the Continent (supplied and installed by The Canadian British Insulated Co., Limited, for the King Edward Park Company,) No. 6 B. & S. Gauge, 3 conductor, paper insulated, lead covered double wire armoured and juted.

1 $\frac{1}{2}$ miles long-13,200 volts

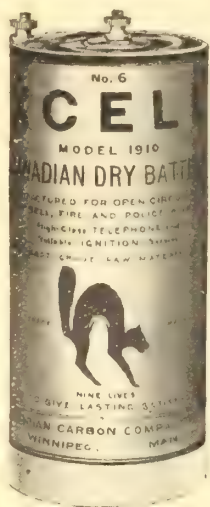
We are prepared to undertake contracts for the Supply and Installation complete of Power Cables under a Five Year guarantee.

We want your enquiries

Canadian British Insulated Co.

Head Office, MONTREAL

Limited



The Trade of The West

is firmly linked
up with the

X CELL DRY BATTERY

(Made in Winnipeg)

Dealers find that in ordering X CELLS they can depend upon getting absolutely fresh, live cells. Battery users buy X CELLS with confidence, for the same reason. This month and the next three months constitute the *big battery season*. If you haven't stocked X CELLS write us and we will put you in touch with the nearest jobber.

Canadian Carbon Company
of Winnipeg, Limited

Bury and Irish Ave., WINNIPEG

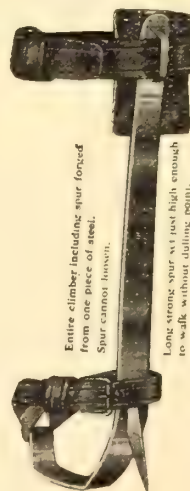
E. W. HANNA, President and Managing Director



TOOLS

Win in Every
Service Test

Because every one is subject to the same constant study of men with years of experience which made possible the



Oshkosh Folding Reel
the Kalkeen Pin
and the Roberts Patent
Climbers

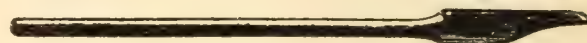
Every one means
Economy and Good Service

Let me prove it to you

James T. Martindale

112 Mail and Empire
TORONTO, ONT.

Representative for
OSHKOSH TOOLS



"BRAIDUCT"

is covering the Dominion like dew - you
can see it everywhere

"Braiduct"

is made in Canada by Canadian labor
and Canadian raw materials, and no ex-
pense or skill is spared to produce,
absolutely the

Best Flexible Conduit

ever made.

Approved and Listed by the Underwriters' Laboratories
Inc.

ASK FOR SAMPLES

The Flexible Conduit Co.,

Limited

Guelph

Canada

John Starr, Son & Co.

Limited

158 Granville St. - HALIFAX, N. S.

Electric Lighting Supplies

LAMPS, SOCKETS, ROSETTES, WIRES, CORDS,
CONDUIT, MOULDING, SWITCHES, CUT-
OUTS, FIXTURES, ETC., ETC.

Large Stocks - Prompt Shipments

Write Us for Low Prices



Sign Receptacles For Electrical Sign Makers

No. 29 is a **self holding** receptacle, strongly made and sheet metal holder. It requires only a plain **round** hole in sign and thus it is more easily and quickly adjusted. Another point is the fact that the making of plain **round** holes is easier on your punches and makes them last longer than if the hole were notched.

No. 988 is a two piece sign receptacle which is now furnished with Mica, insulating point of contact from lamp shells. A thoroughly reliable receptacle of "Duncan Quality."

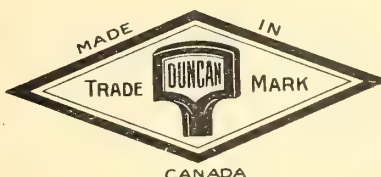
Order from your dealer and if he doesn't stock them write us. Get our new catalogue for your file. It shows many electrical supplies, all of "Duncan Quality."

The
**Duncan Electric
Company, Limited
MONTREAL**

**Makers of Electrical Supplies
bearing this trade mark**



No. 988



No. 29

An Illustrated Story of

These three illustrations tell better than words the remarkable popularity of "*Sunbeam Lamps*." This great business was built on the foundation of service and quality. We solicit your business on a service basis.



St. Catharines, Ontario—August 12th, 1903



Toronto, Ontario—August 1st, 1909

The Canadian Sunbeam

Main Office and Factory **Toronto**
Dufferin and Liberty Streets

Sunbeam Lamp Progress

Sunbeam Carbon and Mazda Drawn Wire Tungsten Lamps are manufactured under the most exacting supervision, thereby guaranteeing you a lamp of the highest efficiency. That is why we guarantee you absolute satisfaction.



Toronto, Ontario, May 3rd, 1912

We will be making lamps in our new factory, August 1st, 1912. Our patrons may expect not only increased efficiency but prompt deliveries of *Sunbeam Carbon and Mazda Drawn Tungsten Lamps* made by expert lamp makers who make nothing but quality goods.

Lamp Company, Limited

North Western Office and Warehouse
173 McDermott Avenue Winnipeg

Northern Aluminum Co.

Limited

Works :

Shawinigan Falls, Que.

Office :

1503 Traders Bank Building, TORONTO

MANUFACTURERS OF

Electrical Conductors for Railway Feeders and Transmission Lines

Ingots, Sheets, Wire, Tubing and Castings

We have supplied ALL the High Tension Aluminum Cable on the following Systems :

Hydro-Electric Power Commission of Ontario.

City of Winnipeg, Manitoba.

Shawinigan Water and Power Company.

British Columbia Electric Railway Company, Vancouver.

Vancouver Island Power Company, Vancouver, B. C.

City of Nelson, B. C.

Nipissing Power Company, Limited, North Bay, Ontario.

Seymour Power & Electric Company, Ltd., Campbellford, Ont.

Simcoe Railway & Power Company, Limited, Midland, Ontario.

Porcupine Power Company, Limited, Porcupine, Ontario.

Prices with full information on application

Northern Aluminum Co., Limited

1503 Traders Bank Building TORONTO, ONTARIO

Why Let Your Lines Operate Without Lightning Arresters?

To Managers

Your men who are directly responsible for the safety of expensive electrical apparatus, want the protection afforded by good lightning arresters. Don't blame them for losses if you don't give them the means of adequately protecting it.

Garton-Daniels Lightning Arresters do protect your apparatus. And that you run no risk in using these arresters every one is sold under the accompanying guarantee.

Guarantee

All Garton - Daniels Alternating Current Lightning Arresters sold by this Company or by any electrical Jobber are guaranteed **unconditionally** for one year from date of sale. If for **any reason whatsoever** they prove unsatisfactory during that time, they may be returned to the Electric Service Supplies Co's. factory, Philadelphia, Pa., where they will be either repaired or replaced free of charge, or the entire purchase price refunded, at the discretion of customer.

Don't put off getting lightning protection. Next week or the next may be too late.

Carried in stock in Canada by John Millen & Son, Montreal, Toronto, Winnipeg and Vancouver, and by Jobbers generally throughout the world.

ELECTRIC SERVICE SUPPLIES Co.

Railway Material and Electrical Supplies

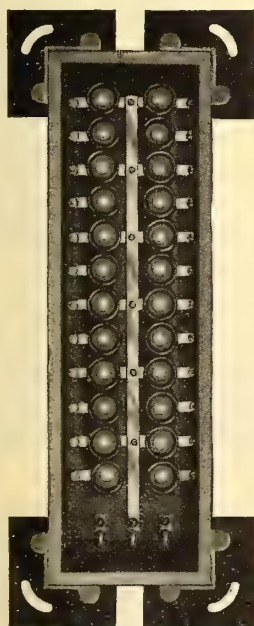
PHILADELPHIA
17th and Cambria Sts.

NEW YORK
Hudson Terminal

CHICAGO
417 So. Dearborn St.

Type F-2, 3500 volt arrester. Air gap of 9/64 inch insures protection. Low resistance of 400 ohms prevents surges and other voltage disturbances. The circuit breaker prevents grounds and short-circuits.

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Better than any other way

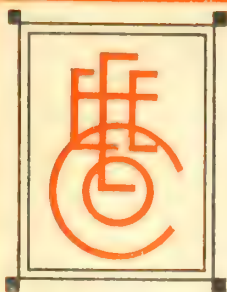
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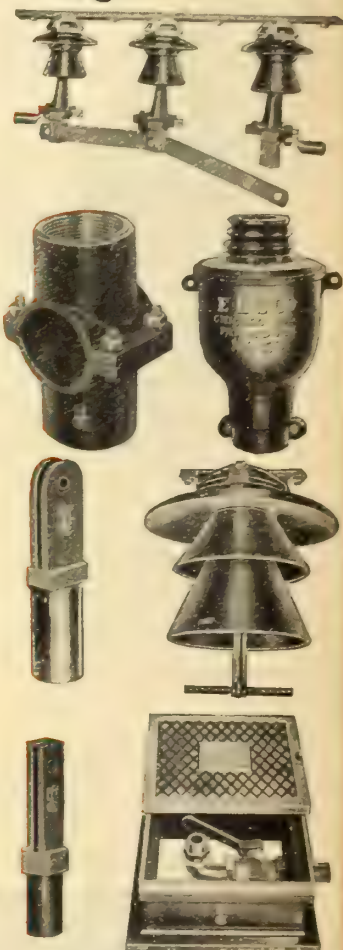
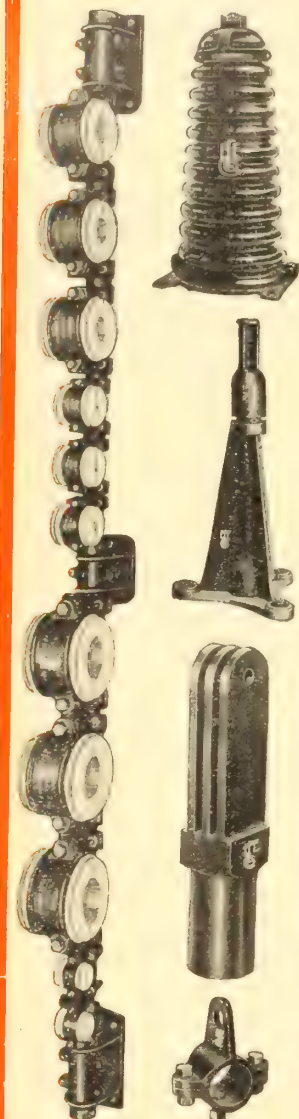
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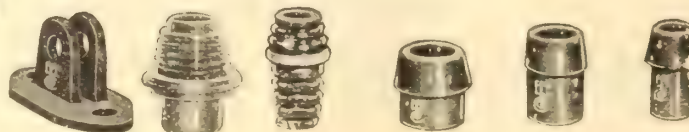
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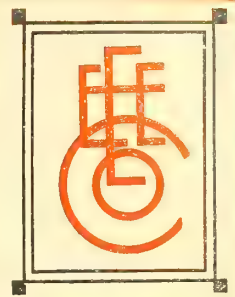
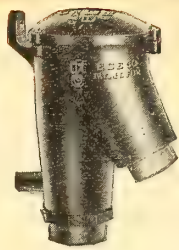
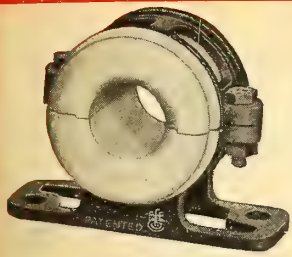
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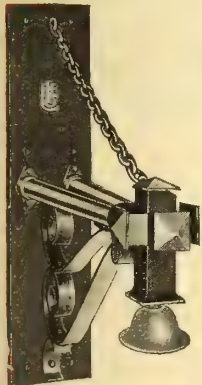


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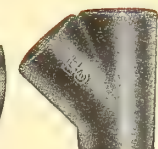
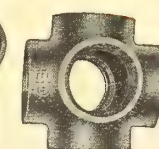
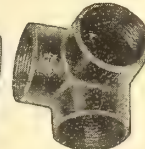
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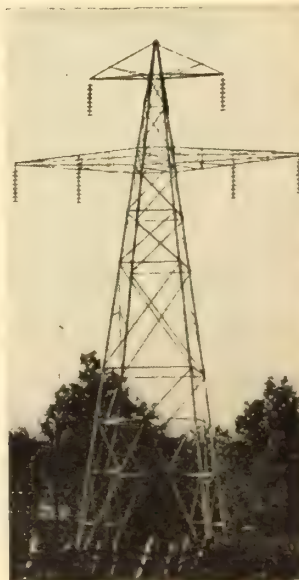
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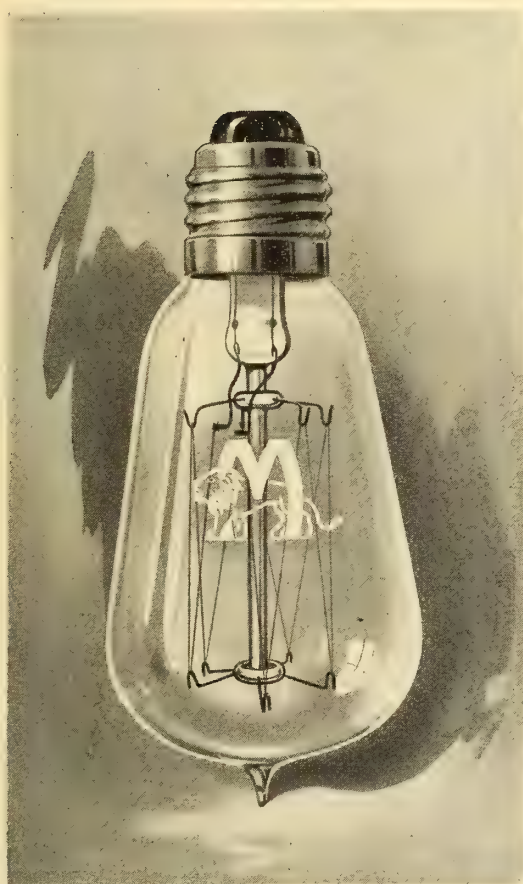
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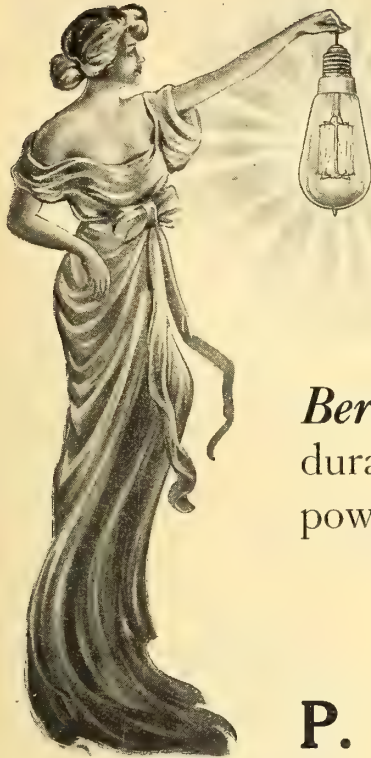
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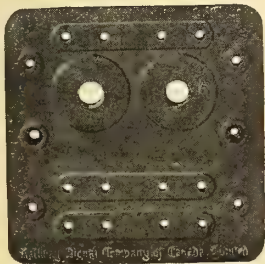
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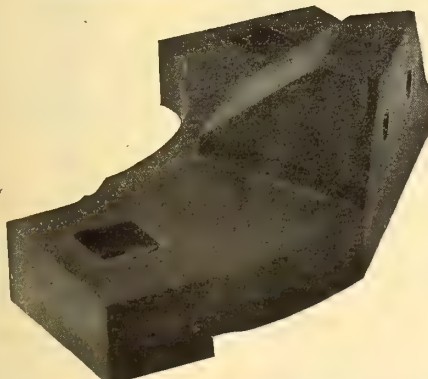
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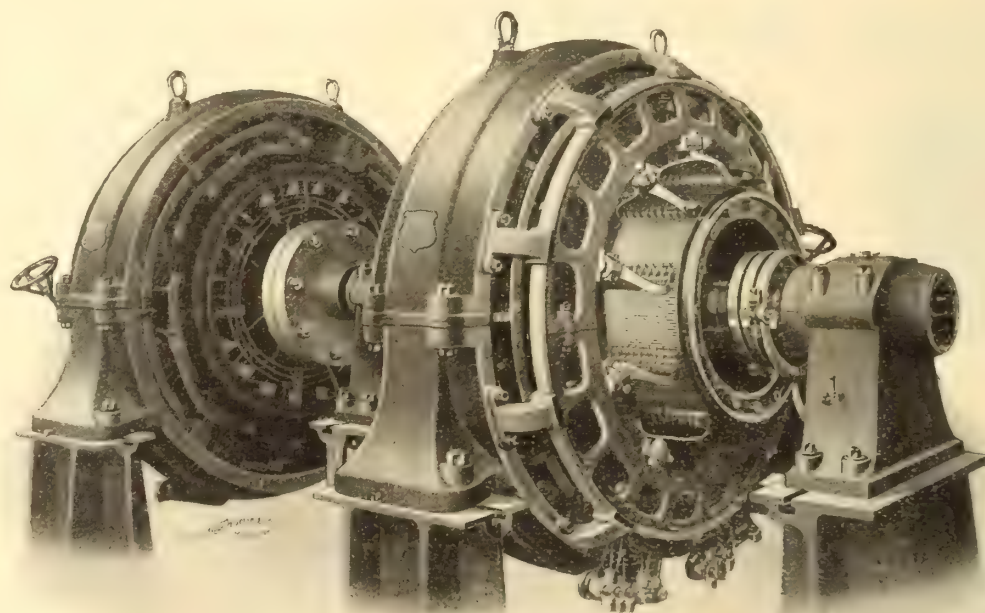
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A polarized loud-ringing bell for telephone service and for use on alternating-current power circuits up to 220 volts.

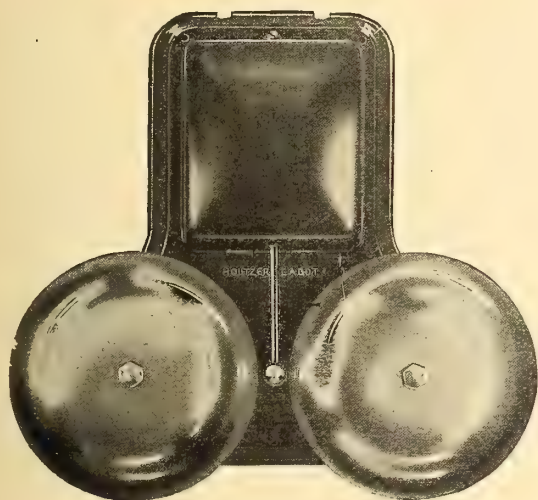
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Long Life Bearings
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Extra Strong Starting Torque
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In the C. W. motor the slots are first made open, allowing plenty of space for the inserting of heavily insulated form-wound coils, and are then closed by magnetic wedges which give all the electrical advantages of "closed slot" construction. The cut shows how the magnetic wedge "E" increases the distributing area of the tooth and allows the flux to travel a shorter path than is the case where the wood-wedge "P" is used.

For a further discussion of this subject and other interesting advantages of these motors write for induction motor booklet "E."

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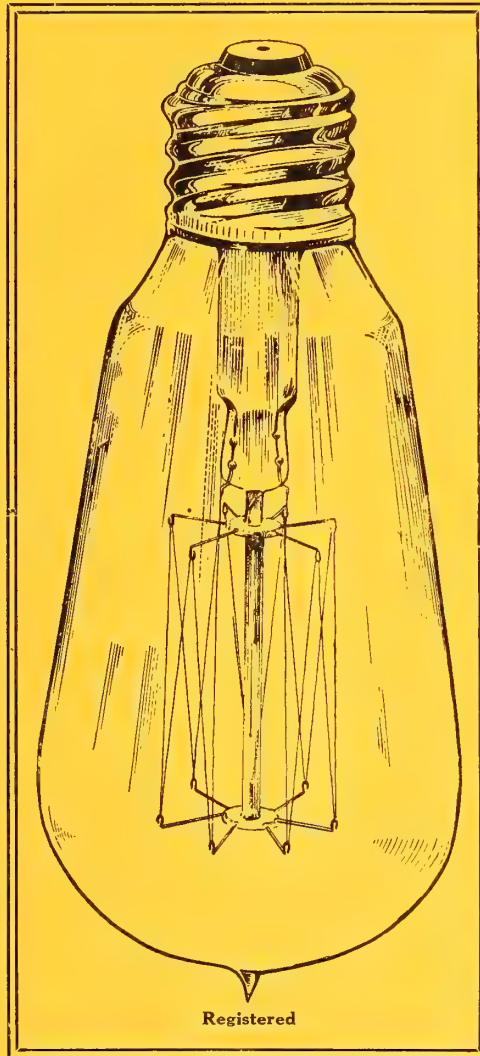


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Drawn Wire Tungsten Lamps

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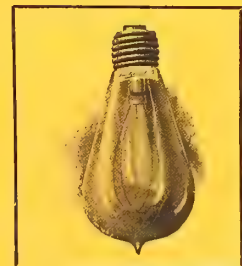
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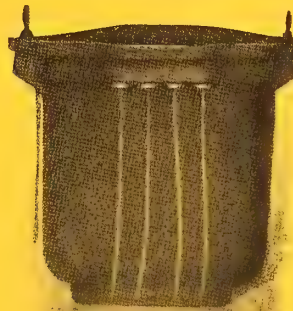
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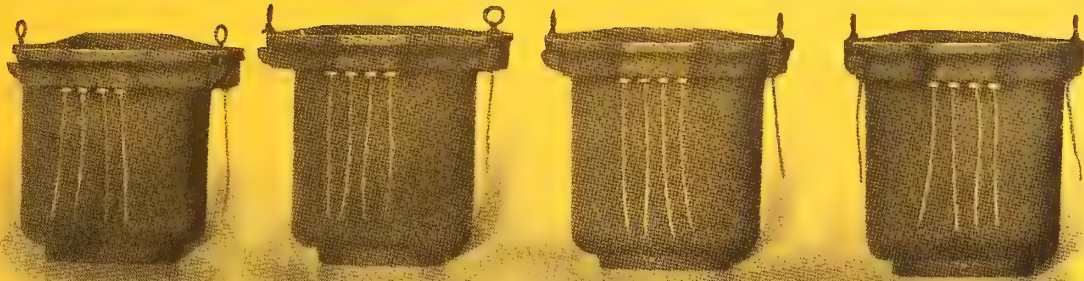
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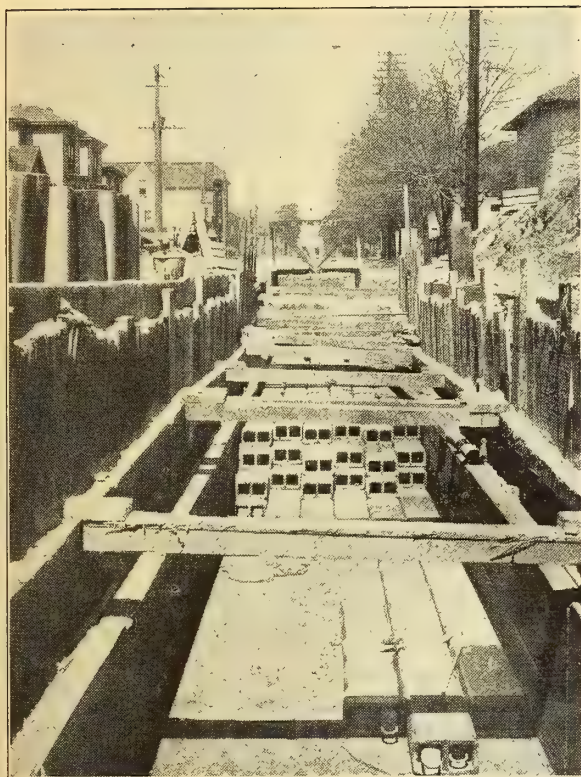
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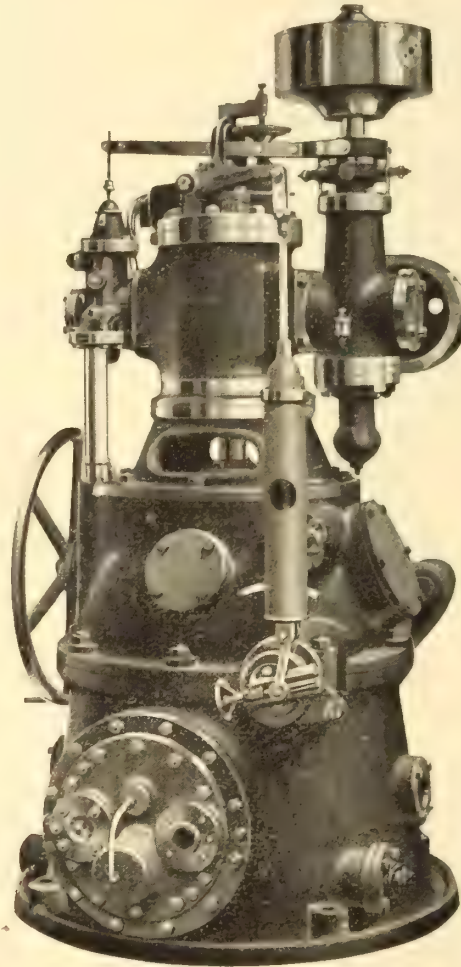
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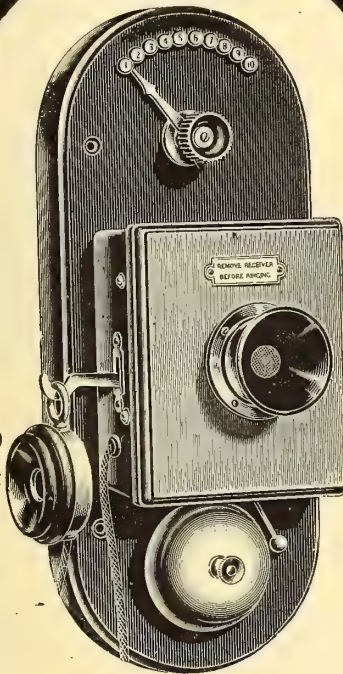
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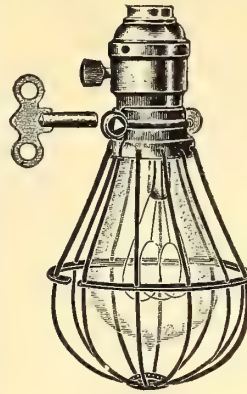
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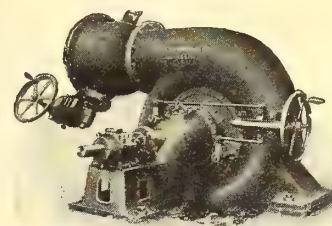
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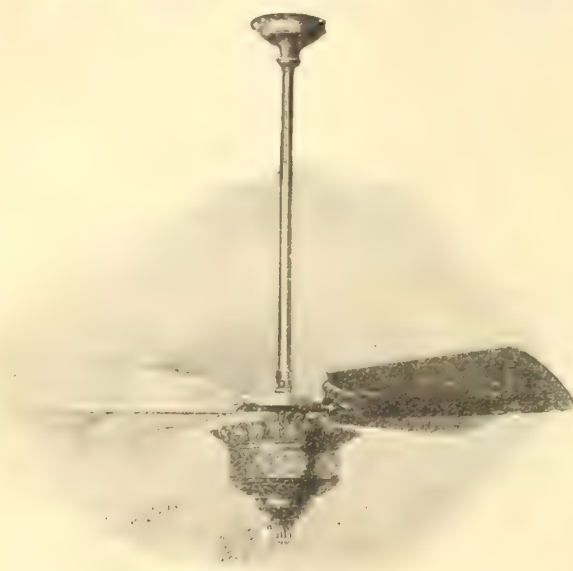
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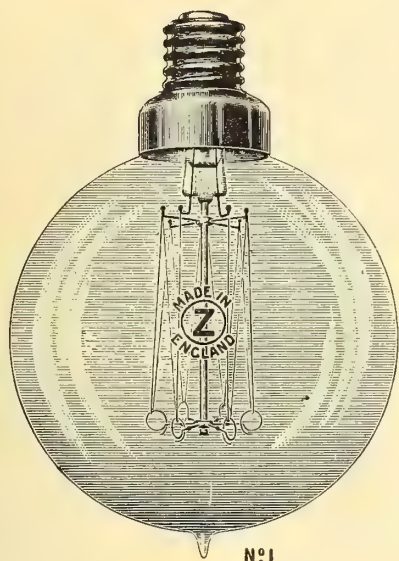
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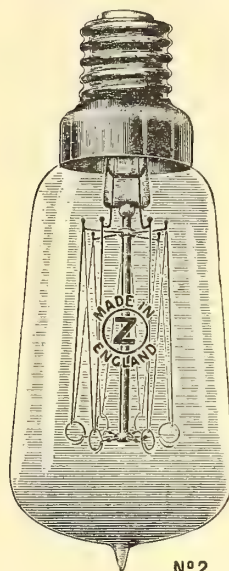
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N°2



N°7

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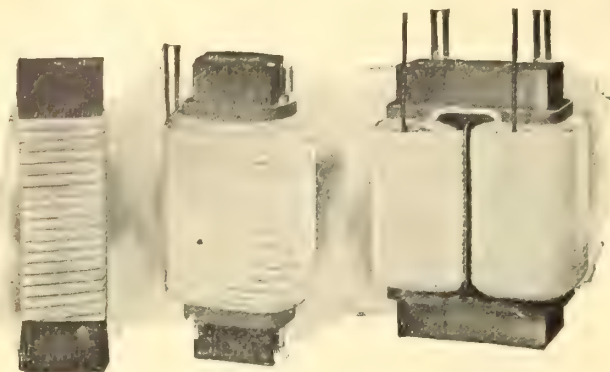
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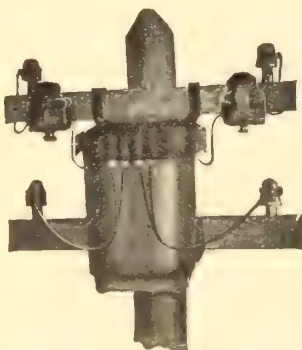
Interior view Type H. E. Transformer Coils and Core. Note small number of parts.

There is nothing complicated about Moloney Transformers, as may be seen by the accompanying illustrations. Nothing to get out of order or wear out.



Type C. Oil-Cooled Transformer. Front view, showing lead wires and general appearance.

Core loss is the most important factor in the design of a good transformer. Core loss is constant and continues every hour the plant is in operation, even though the transformer may not be delivering current off its secondary. Therefore, a transformer having a low core loss means high all-day or commercial efficiency, and low operating cost on a lighting system. Simplicity and Efficiency combine to make Moloney Transformers the standard of America.



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Canadian Moloney Electric Co.

Limited

Office and Works, Windsor, Ont.

DISTRICT OFFICES: J. D. Lachapelle, 512 Canadian Express Bldg., Montreal, Que. A. Ross Osborne, 616 Continental Life Bldg., Toronto, Ont. T. J. E. Papineau, 5 Hample Building, Winnipeg, Man. Hinton Electric Company, 606 Granville Street, Vancouver, B. C.

These Trade-Marks Denote Established Standards of Quality

CONDIT

Oil Switches and Circuit
Breakers

T. & B.

Thomas & Betts Conduit
Boxes and Fittings



Improved Blue
Bell Battery



Klein's Construction
Tools



Quality

Each Trade-
Mark is Your
Guarantee of
Quality and
Economy

Service

The Large As-
sorted Stocks
in Our Houses
Allow Imme-
diate Ship-
ment on All
Standard Ma-
terial

HOLOPHANE



THE *Northern Electric*
AND MANUFACTURING CO. LIMITED



Montreal

Toronto

Winnipeg

Regina

Calgary

Vancouver

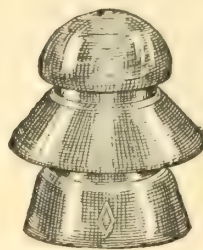
THESE TRADE ESTABLISHED STANDARDS



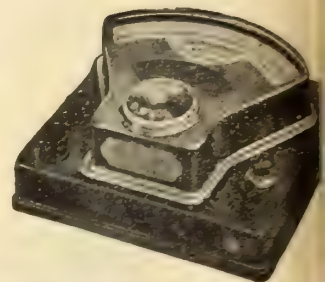
THE WIRE & CABLE COMPANY



DUNCAN SOCKETS AND CUTOUTS



DIAMOND GLASS INSULATORS



WESTON ELECTRICAL MEASURING INSTRUMENTS

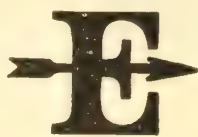


DRY BATTERIES

TRADE MARK
"Chloride Accumulator"

REGISTERED SEPTEMBER 11, 1904

STORAGE BATTERY



ARROW ELECTRIC SWITCHES



HUBBELL SPECIALTIES

"Exide"
 REGISTERED APRIL 2, 1901

VEHICLE BATTERY

QUALITY

Each Trade Mark is Your Guarantee of Quality and Economy



(Reg. U. S. Pat. Off.)



LORICATED AND GALVADUCT CONDUIT



SKELETON AND ENCLOSED SIGNAL BELLS



METAL PANEL AND CUTOUT BOXES

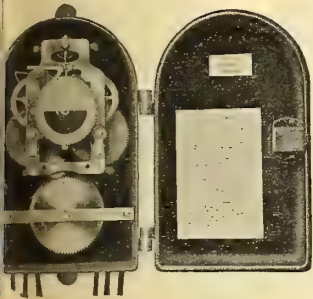


THE **Northern**
 AND MANUFACTURERS

MONTREAL TORONTO WINNIPEG

ADDRESS

MARKS DENOTE STANDARDS OF QUALITY



HARTFORD TIME SWITCHES

WARD LEONARD

RHEOSTATS AND CONTROLLERS

SERVICE

Large As-
orted Stocks
Our Houses,
allow Immed-
ate Shipment
all Standard
Material

BROOKFIELD
STANDARD GLASS
INSULATORS

EDWARDS & CO., INC., HOUSE GOODS

IMPERIAL WIRE & CABLE CO
LIMITED"D & W" FUSES AND
CUTOUTSP. & B. INSULATING
COMPOUNDSCROUSE-HINDS
CONDULETS AND
PANEL BOARDSNORTHERN SIX
DRY BATTERY

Inter-phones

MAZDA
LIGHTING FIXTURESHIGH AND LOW VOLTAGE
INSULATORS

(Reg. U. S. Pat. Off.)

Electric

RING CO. LIMITED



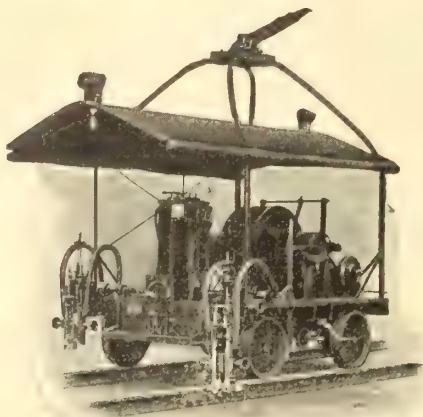
WEST HOUSE

REGINA

CALGARY

VANCOUVER

Electric Weld Rail Bonds



The conductivity of Bonds installed by our process can never be impaired by moisture or corrosion.

When once installed, they are on to stay and cannot be removed without actual mutilation and considerable hard work.

Write for Booklet

The

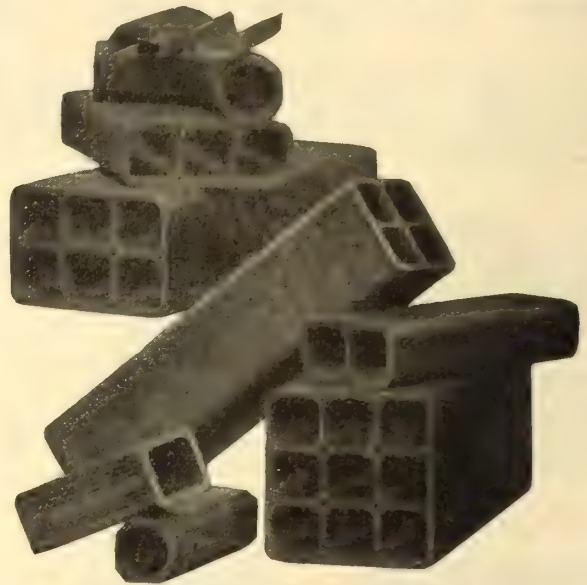
Electric Railway Improvement Co.

Office and Works, 6005 Carnegie Avenue
CLEVELAND

American Sewer Pipe Co.,

AKRON, OHIO.

Vitrified Conduit—Best Made



Among our Satisfied Customers are Cities of
Toronto, London, Calgary.

Ask Them.



Fig. 1

The American "Beauty" Iron

The "Beauty" type Electric Iron is the newest and latest "American" Electric Iron. It leaves nothing to be desired in an electric iron, either from the user's or dealer's standpoint.

Fig. 1 shows the Hood or Top, Pressure Plate, Heating Element and Bottom Plate which go to make up the complete iron shown in Fig. 2, and will give some idea of the simplicity and efficiency of construction of this famous "Beauty" type iron.

"American" Electric Irons are the embodiment of efficiency, economy, convenience, comfort and cleanliness and are backed by the fairest and most liberal guarantee ever offered by a reliable manufacturer.

Write to-day for Bulletin No. 2035.



Fig. 2



THE Northern Electric
AND MANUFACTURING CO. LIMITED

Manufacturers and Distributors of Telephone Apparatus, Electrical Supplies, and Fire Alarm Apparatus for every possible need.

MONTREAL

TORONTO

WINNIPEG

REGINA

EDMONTON

CALGARY

VANCOUVER



J-M FIBRE CONDUIT

"The Strongest Conduit Made"

WILL LAST INDEFINITELY



The long life of J-M Fibre Conduit is due to the bituminous compound used in preserving it. This compound is a product of nature and is the same, in chemical analysis and mechanical characteristics, as the composition employed in the preservation of Egyptian mummies in perfect condition for thousands of years.

The conduit, being thoroughly saturated with this composition, is therefore indestructible. Not affected by bacteria or decaying vegetable matter. Will withstand high temperatures without injury. Eliminates abrasion of the cables and electrolysis.

Comes in standard tube lengths, 60 inches long, 2 to 4 inches in diameter.

Write our nearest branch as to your requirements and ask for descriptive booklet.

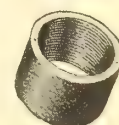
The Canadian H. W. Johns-Manville Co., Limited

Manufacturers of Asbestos
and Magnesia Products

ASBESTOS

Asbestos Roofings, Packings,
Electrical Supplies, etc.

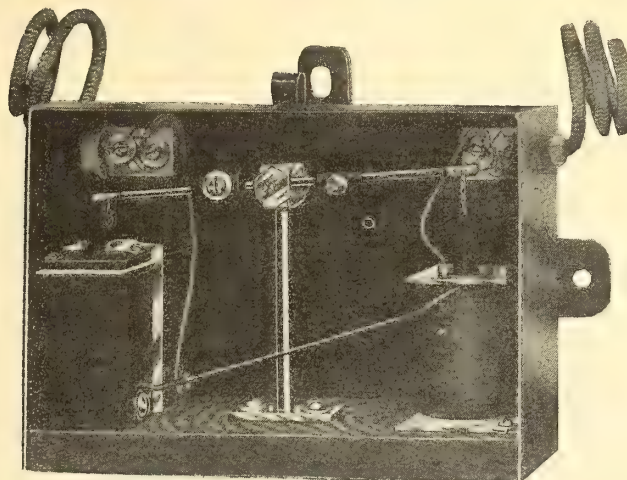
TORONTO, ONT. MONTREAL, QUE. WINNIPEG, MAN. VANCOUVER, B.C.



Overload Does Not Injure This Controller

THE SHEDRICK ELECTRIC LIGHT CONTROLLER OR LIMITER

Not Made
to
Last a Year
But a
Lifetime.



A
New
Departure
in
Controllers

Result of test of a ten light controller put in circuit with an overload of four lights (fourteen in all) with an average make and break of one hundred and twenty per minute (330,000 strokes)—more than any instrument would be subjected to in a lifetime—showed absolutely no injury in any way to Controller.

SATISFACTION GUARANTEED—WRITE TO-DAY FOR PRICES

Electric Specialties Manufacturing Company
157 Craig Street West, Montreal



T T C TUNGSTOLIER

The above cut shows our latest development, a new kind of fixture, made in sections, all parts are wired, interchangeable, and easily put together. Catalog No. 110A, is now ready for distribution. It will explain how it is done.

It Will Pay You

to keep closely in touch with us at all times, as we are always "doing things." We manufacture fixtures and lighting units scientifically, i. e.—not as so much brass thrown together, but bearing in mind that the dealer must install same and the consumer must be satisfied. We have done this for both dealer and consumer by using thought in the manufacture, we minimized the expense of installation, and by perfection of design and finish we assure most lasting satisfaction to the consumer.

Write us at once for all our catalogs and information.

The Tungstolier

COMPANY



of Canada, Limited

Head Office

212 King Street West

TORONTO

Monarch Electric Co.

PHONE:
Main 3988,
Montreal Exchange

St. Lambert, P.Q.

Limited

Take Notice of These Our Silent Salesmen

WHY PURCHASE Goods
Abroad?

When you can get
better satisfaction
at home and
help your
own country

WE
ALSO
MAKE
Sockets,
Rosettes,
Lamp Goods,
Trolley Brackets,
Special Transformers,
Etc., Etc.

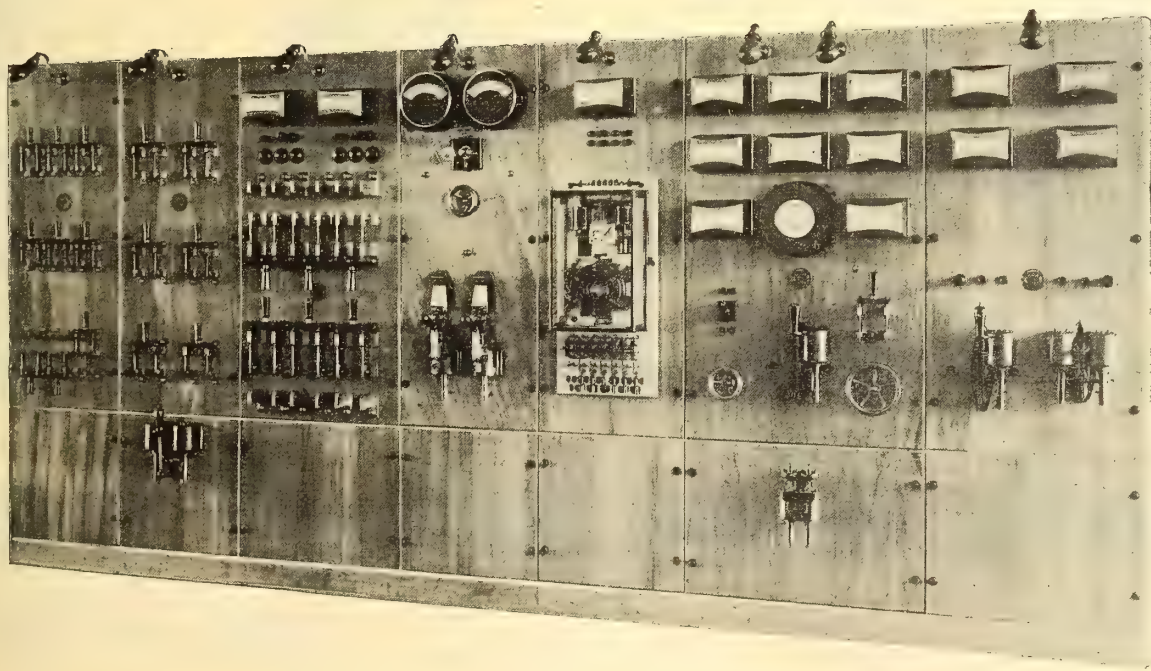


Our large
experience
is at your
service.

Try us.

You will tell others

We are Switchboard Specialists

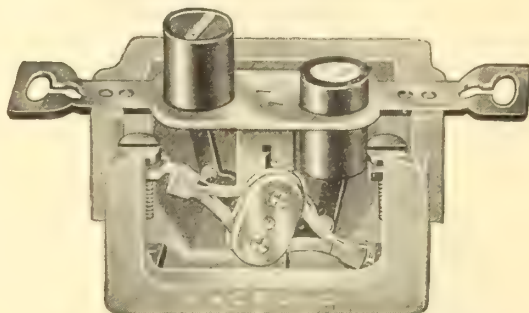


"Excello" Switch Specialties

Are built up to a standard not down to a price

The Excello line of Push Button and Tumbler Switches have been developed with the purpose of giving both the contractor and user absolute satisfaction

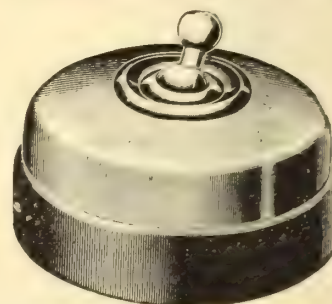
EXCELLO P. B. TYPE



Easy Push and Strong Action

Large contacts and liberal current carrying capacity.

EXCELLO FLAT TYPE



The simple action of an Excello Tumbler Switch is more desirable than the noisy snap action of a Rotary Switch.

"Stave-Arco"

The Longest Life from the Shortest Flaming Arc Lamp



The Lamp for City Lighting, Factory Lighting, Any Lighting

100-135 Hours per Trim

Strong, sturdy carbons—globes always clean—

One pair of carbons only—No Magazines.

Total Height of lamp is but 32".

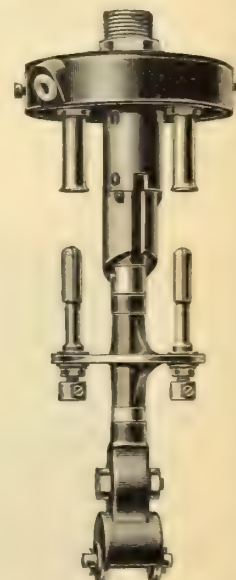
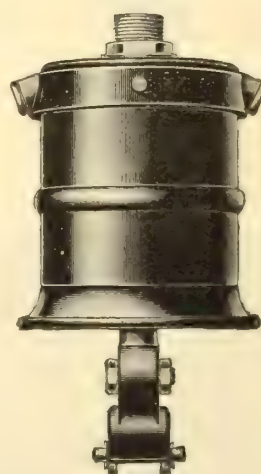
Positive, steady feed produces unflickering white or yellow light.

550 watts—3000 C. P.

Burns on 10 amp. constant potential and constant current circuits.

"EXCELLO"

Automatic Arc Lamp Cutout



Just the thing for disconnecting and lowering Arc Lamps for Trimming.

Engineering Equip

410 St. James S



SOME FRANK CHAPTERS

It may almost be said that pin type insulators are standardized and they have gradually been strengthened so as to have a flashover point so low compared to their puncture strength that we are hearing very little about pin insulator troubles now. But suspension insulators? The flashover value of most designs offered is so near the puncture danger point of the porcelain used that the field is full of woe and disappointment.

It is offered by a salesman as an assurance of safe operation that since the suspension insulator unit is tested at the factory (low frequency) at a much higher voltage than its proportion of the factory flashover voltage of the series of units, such units are shielded from harm under operating conditions. Dangerous line surges are of high frequency, increasing the danger of puncture and resultant discharge cannot be gently led around a frail insulator. A tallow candle may be shot through a pine board (high frequency line discharge) but all the king's men couldn't push a candle through (low frequency ordinary factory test).

It is true that "Victor" insulators are given no mercy under factory test.

THE LOCKE INSULATOR MFG. CO., Victor, N.Y.

OR

Engineering Equipment & Supply Company

410 St. James Street,

MONTREAL, QUE.

We Carry Large Stocks of Electric Carbons

FOR { Open and Enclosed Arc Lamps
Stave Arco and Regenerative Flame Lamps
Projection Arcs

We carry all the principal makes and can give you that best suited for your requirements

Headquarters for Tungsten and Carbon Incandescent Lamps

ment & Supply Co.
MONTREAL



One Large Electric Truck Consumes More Current Than A Whole Block of Residences

AND just *one* Electric Pleasure Vehicle will consume as much current as *three* residences. Think of that, Mr. Central Station Official—then consider if you are giving Electric Vehicle business the time and attention its importance *demands*.

There is no question *now* about the Electric making good—it is here to *stay*—and the sale of current for charging batteries is one of the most profitable sources of income to any lighting company. But—the success of the Electric in any community *depends* on the Central Station management.

Buy Electric Vehicles For Your Own Use —Push Their Sale to Others

Electric Vehicles are not only income-producing, “valley load” business for you but also a source of pleasure and profit to their purchasers. There is no need to claim anything for the Electric it cannot do. Just emphasize *steadily* that the Electric Pleasure Vehicle is the ideal town car. Prove to the business man, who should use Elec-

tric Commercial Vehicles, *why* he should buy them. We are conducting a nation-wide advertising campaign for the Electric, both pleasure and commercial, in a great number of national magazines and a long list of trade journals. Upon request, we will be glad to show you how we can link this national campaign to *your* Central Station.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA

BOSTON

NEW YORK: 245 W. 42nd St.

CHICAGO

97 CENTRAL STATIONS

ARE NOW USING

388 G. V. ELECTRICS

These wide awake stations know what quality in design and manufacture mean if you would have your vehicle run ten years at a low maintenance.

Three central stations use 84 G. V. trucks and wagons. Many of the 388 are from 3 to 9 years old.

OVER TEN MILLION K. W. HOURS

will be required to charge the G. V. electrics in operation by July 1, 1912, and the bulk of these machines will be charged at the **off peak!**

Think that over.



One of 58 ordered since last November

Our 1,000 lb. wagon consumes approximately 5040 K. W. H. in 300 days full charging, the 2-ton 7,890 and the 5-ton 11,850. Compare a fleet of ten 5-ton trucks with your flat iron and washing machine load. Yes, even your residence load.

781 G. V. TRUCKS USED BY 25 CUSTOMERS

There are **thousands** of G. V. trucks in use, 781 of them by 25 firms—an average of 31.6 per customer. We have sold 1,082 in one city.

G. V. trucks combine age, experience and prestige. Many built in 1901-02 are still in service. We build a good truck, sell it only where it will "make good" and keep our eye on it after it is sold. Ask about our maintenance guarantee.

Made in six standardized models of the following capacities: 750 lbs., 1,000 lbs., 2,000 lbs., 2-ton, 3½-ton and 5-ton.

Illustrated catalog 69 and full information on request.

GENERAL VEHICLE COMPANY

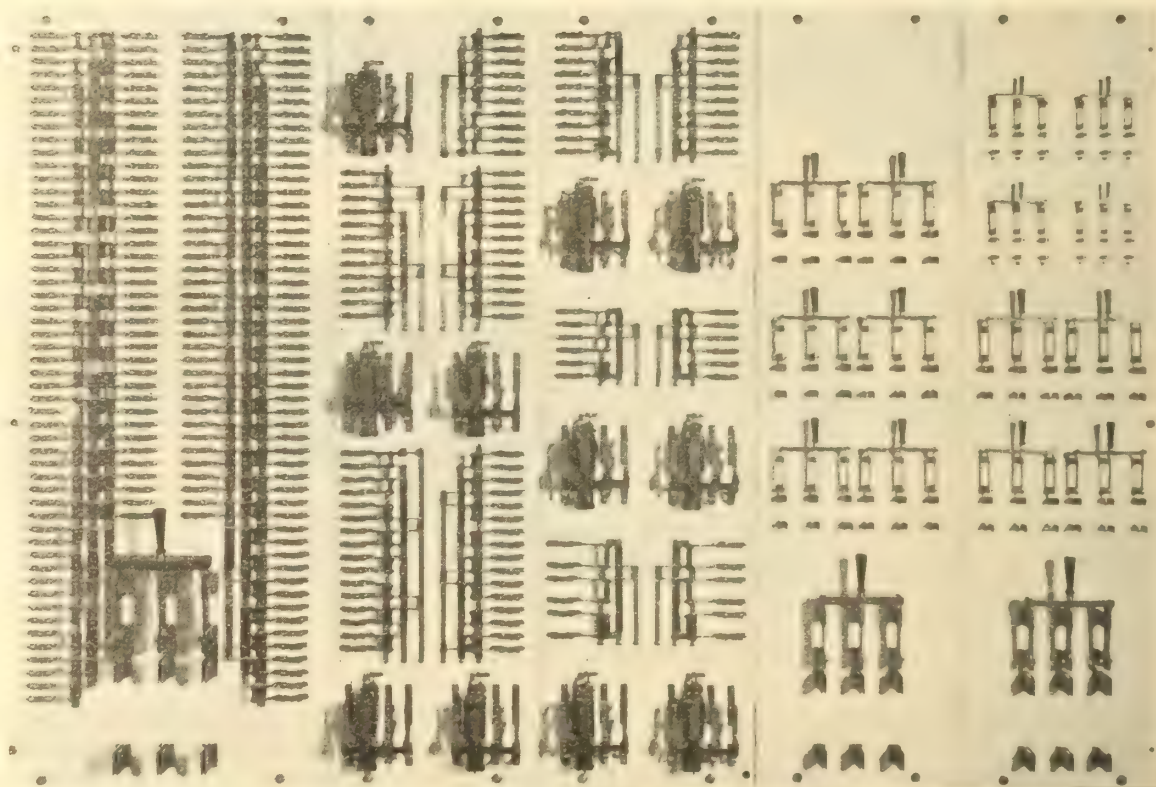
Principal Office and Factory: LONG ISLAND CITY, N. Y.

BOSTON NEW YORK CHICAGO PHILADELPHIA ST. LOUIS

Canadian General Agents: R. E. T. PRINGLE - Montreal, Windsor, Ont., Toronto

KRANTZ

The Name That Stands for the Best
in Switchboards and Panel Boards

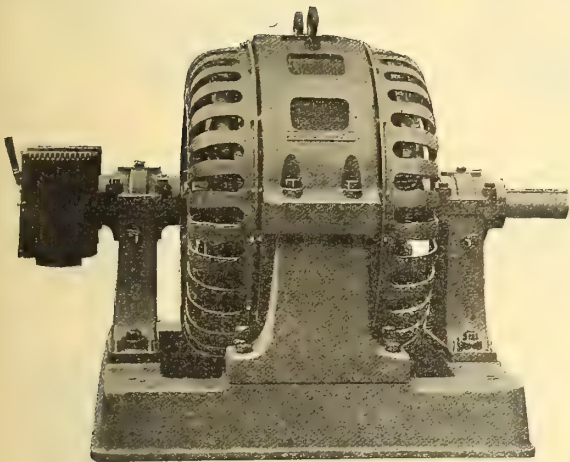


Combination Panel Board and Switchboard

KRANTZ Switchboards and Panel Boards have an international reputation for reliability and efficiency. ¶ Years of practical experience and specialization has resulted in perfection of design and detail. ¶ The fact that the foremost electrical engineers of America have specified "Krantz" boards for the leading hotels, terminals and Municipal Buildings is an acknowledgement of their superiority. ¶ Krantz Switchboards and Panel Boards have been installed in nearly all the new Government Buildings in both Canada and the United States. ¶ Send in your next specifications.

The C. H. L. Keeler Company

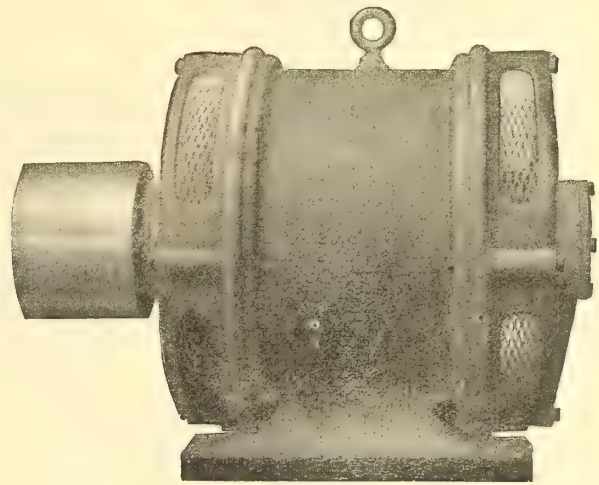
PHOENIX INDUCTION MOTORS



300 H.P. Mining Motor with Enclosed Slip Rings

THE new series of two and three phase "Phoenix" Induction Motors embody all the latest improvements. By a judicious disposal of the materials employed in their construction they are exceedingly compact and occupy a comparatively small space.

PHOENIX Motors are adapted for the most exacting requirements of motor service. The construction is the best throughout, and the most important and minute details essential to the successful operation of the machines have received every consideration. Phoenix motors are doing duty in every part of the Empire.



Standard Semi-enclosed Squirrel Cage Induction Motor

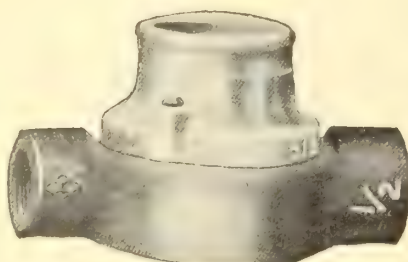
The Phoenix Dynamo Manufacturing Co.
Bradford, England Limited

Write for Bulletin to Our Canadian Agents

Limited : Toronto, Ontario

Conduit Pipe Fitting Covers

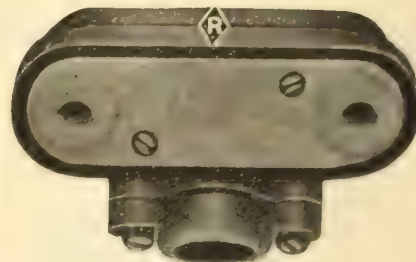
For Every Electrical Purpose



G with Receptacle



L R 3 Wire



F 2 Wire



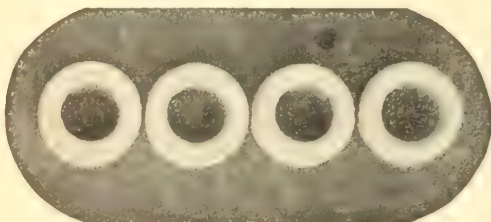
$\frac{3}{4}$ in. No. 403



1 in. No. 403



$\frac{1}{2}$ in. No. 303



1 in. No. 504



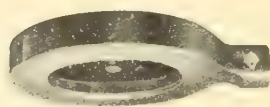
L B 2 Wire



C 4 Wire



A 3 Wire



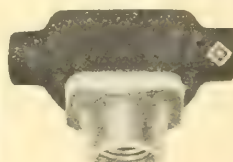
P $\frac{1}{2}$ "



No. 1915 - Switch Box



K $\frac{1}{2}$ "



U $\frac{1}{2}$ "



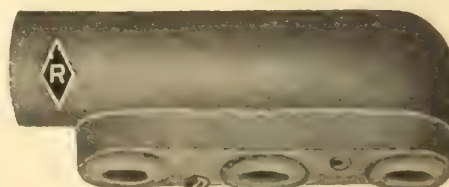
H $\frac{1}{2}$ " 5 Amp.



T 2 Wire



F D $\frac{1}{2}$ "



E 3 Wire

ELECTRICAL FITTINGS CO., LIMITED

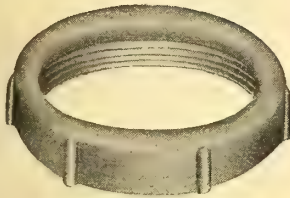
70 King Street West, TORONTO, Canada

British Columbia Agents:—Cope & Son Ltd., 132 Water St., Vancouver, B. C. Quebec City Agents:—Mechanics Supply Co., Ltd., 80-90 St. Paul St., Quebec, Que.

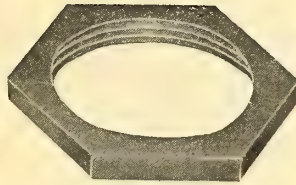
"MADE IN CANADA"

Write for Catalogue No. 3. If your Jobber cannot supply, write us.

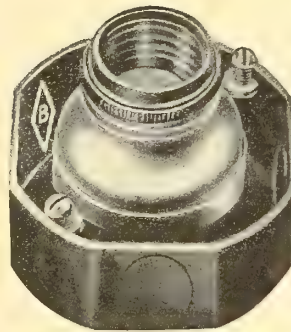
Electrical Supplies



1 1/4" Bushing



1 1/4" Locknut



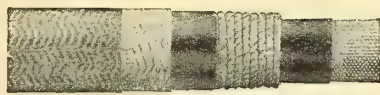
No. 6350 Box and Receptacle



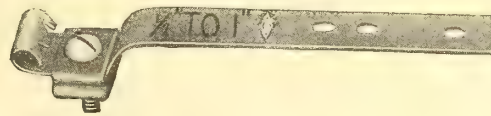
No. 1915-Box and No. 3719-Cover



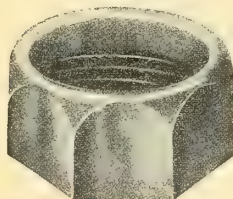
1455-Reversible Guard



Alphaduct



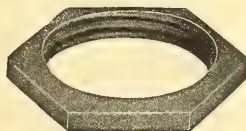
1/2 to 1" Grounding Clamp

81 A 3/8
Fixture, Stem

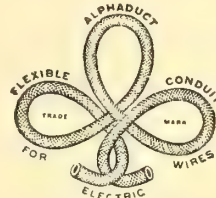
1/2" Bushing



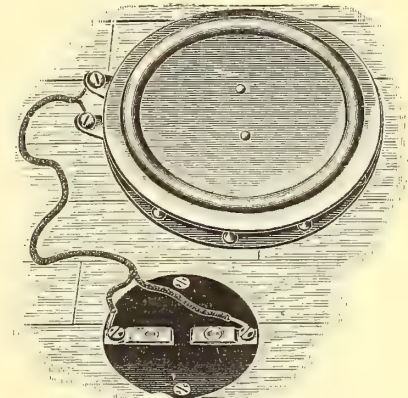
Pipe Strap



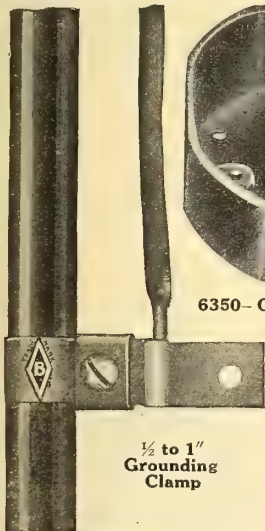
1/2" Locknut



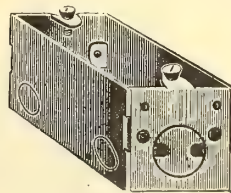
Alphaduct 1/4"



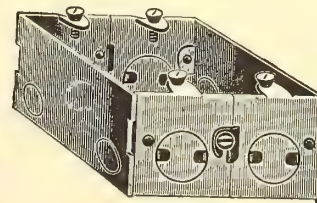
1150-Floor Tread

1/2 to 1"
Grounding
Clamp

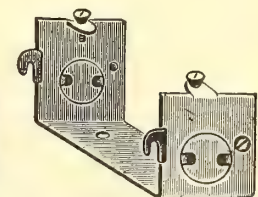
6350-Outlet or Junction Box



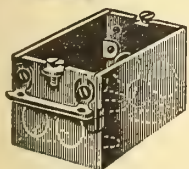
170-Comb Switch Box



172-2 Gang



171-Spacer



C C S. I. Switch Box

Electrical Fittings Co. Limited

70 King Street West, TORONTO, Canada

British Columbia Agents, Cope & Son Ltd., 132 Water St., Vancouver, B. C.

Quebec City Agents, Mechanics Supply Co., Ltd., 80-90 St. Paul St., Quebec, Que.

"Made in Canada"

Write for Catalogue No. 3. If your Jobber cannot supply, write us.

Electrical Supplies of every Description

A few of our specialties :

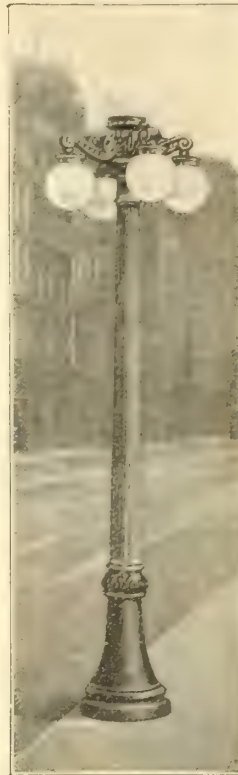
Moloney High Efficiency Transformers
Carbon and Tungsten Lamps
Rigid and Flexible Conduit
Condulets

Large stock ; prompt shipments.

Write for new and complete catalogue No. 3.

**Central Electric & School
 Supply Co., Limited**
 36 Adelaide St. West, Toronto

Ornamental Standards



Poles
Mast Arms
 and
Brackets

**Over Head
 Line Material**

SEND FOR CATALOG
 AND DESIGNS

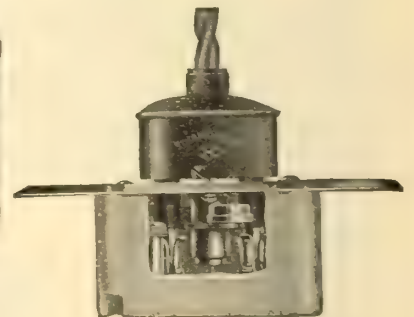
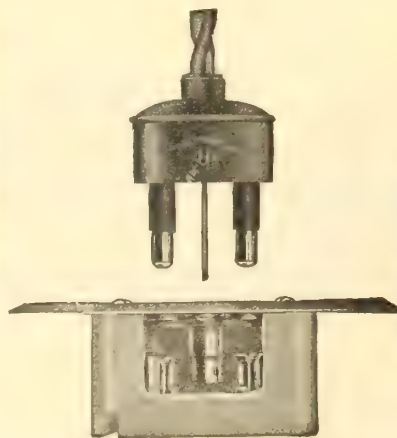
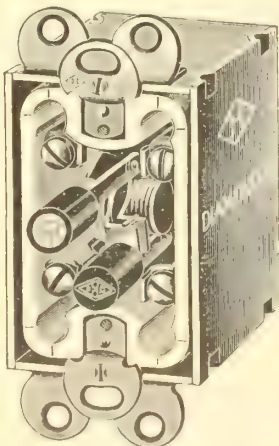
Dawson & Co.
 Limited
 Montreal and Winnipeg

Protect Your Investment in Switches by Specifying "Diamond H"

The best protection for the user because they are dependable in operation. The safest investment for the dealer, engineer or contractor because they give satisfaction.



The "Diamond H" on a switch is valuable insurance—assurance that quality, materials and competent workmanship are embodied to perfect production.



MANUFACTURED BY THE HART MANUFACTURING CO., HARTFORD, CONN.

Canadian Sales Agent:

C. W. Bongard, Toronto, Canada

VISIT AMERICA!

See

The 1912 Boston Electric Show

BOSTON, MASSACHUSETTS, UNITED STATES OF AMERICA

September 28 to October 26, inclusive, 1912

Greatest Electrical Exposition ever held in the World

**Occupying the Entire Mechanics' Building—105,000 Square Feet of
Exhibit Floor Space**

The Street and Building Decorations—and the Illuminating Effects—will be the most Remarkable, Elaborate, and Beautiful ever before seen at an All-Electric Show.

A World-Wide Search has been well rewarded with Novelties, Specialties, and Unique Uses of Electricity.

This Electric Show will also be Unique because every Exhibit will show Moving Appliances and Machinery operated by Electric Power.

Preparations are being made to accommodate an attendance of approximately One Million (1,000,000) people.

Special De Luxe Train from Toronto

The Electric Show Management is co-operating with Representatives of The Toronto Electric Light Company for a special train of the finest cars, finest arrangements, and most complete conveniences to come through from Toronto, bringing people from that city and other points to Boston during the time of the big Show. The cost of this trip will be small in comparison with the opportunities afforded and the comforts obtainable.

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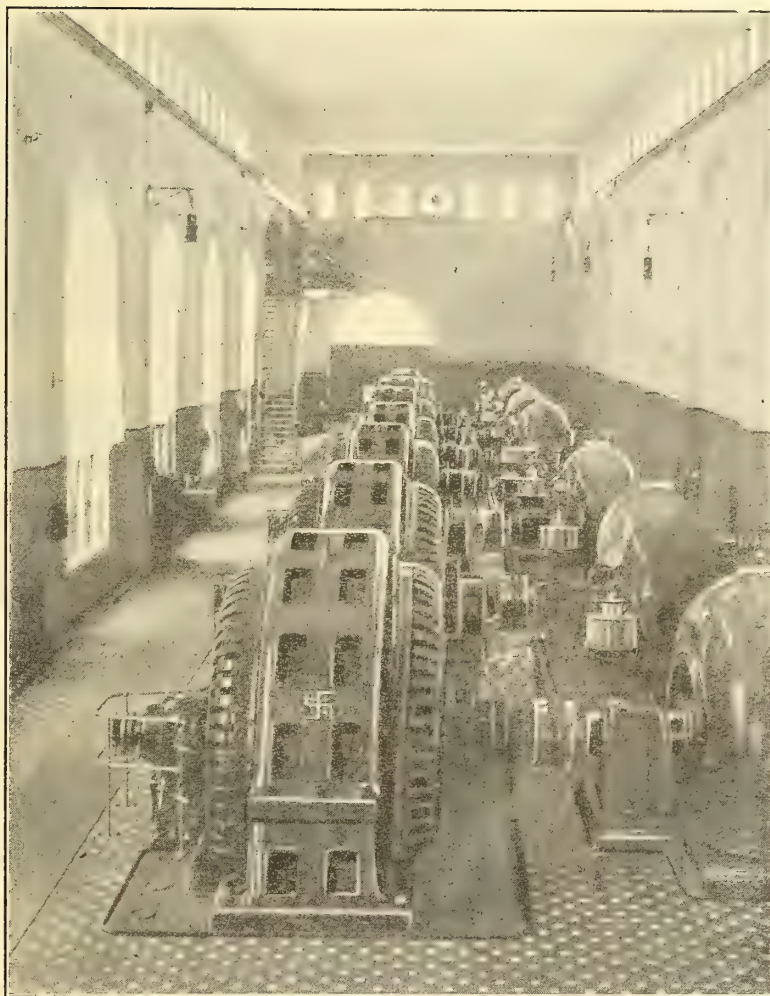
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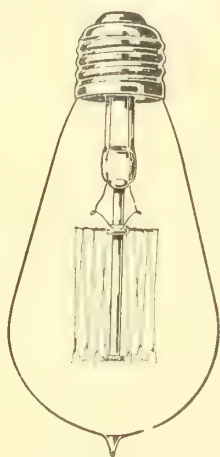
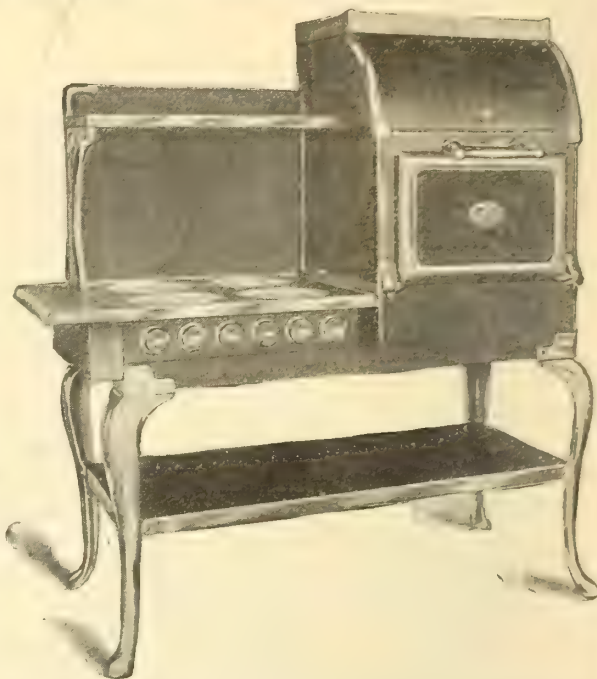
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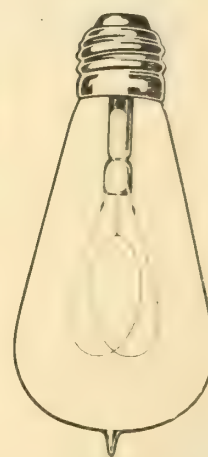
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The Gould stand-by battery in the plant of the Union Electric Light and Power Co., St. Louis

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The Gould Storage Battery that drives trains through to the Michigan Central R. R. Tunnel at Detroit, Mich.

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Works : DEPEW, N. Y.

Canadian Representative : R. E. T. PRINGLE, Toronto, Montreal, Windsor, Winnipeg.



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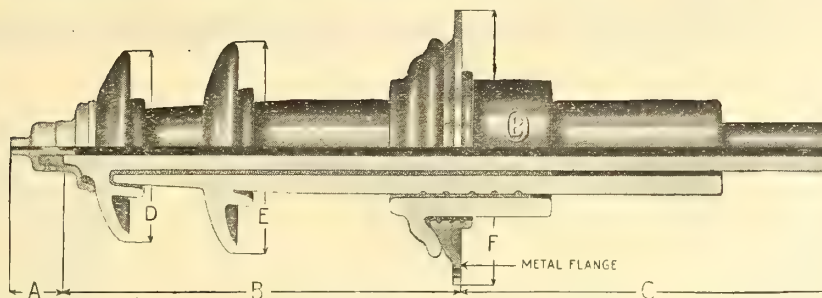
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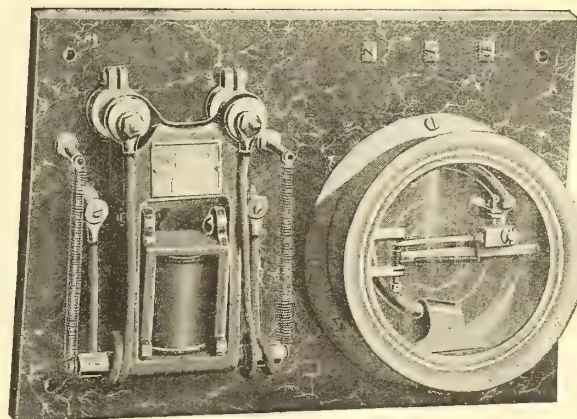
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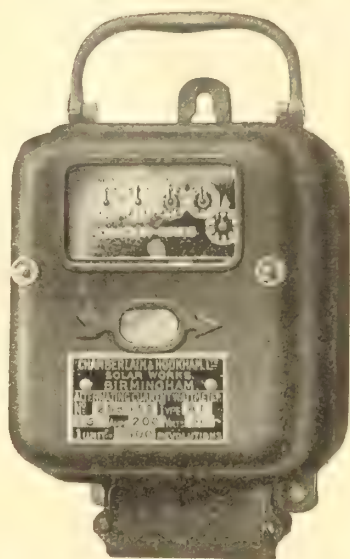
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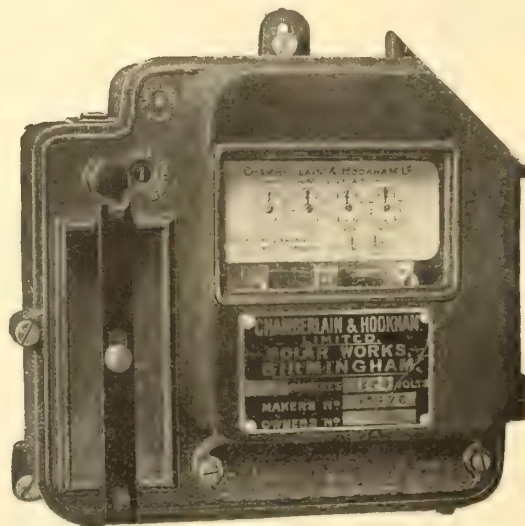
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Shurlok

WHY NOT USE TUNGSTEN LAMPS?

Have you any customers who hesitate to install Mazda or Tungsten lamps, due to the danger of theft? If so, you can assure them that the lamps will not be stolen if they put these lamps in the P & S Shurlok — the socket that locks.

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Electric Light Companies having rental cluster service will be interested in P & S Shurlok — the socket that locks.

One Electric Light Company is saving \$42,000 per annum in lamp renewals alone on an investment of \$8,000 in Shurlok — the socket that locks.

HOW IT WORKS

The illustration herewith will demonstrate how simple the device is, and yet how difficult it would be to unlock the socket without the proper key.

The lamp is shown locked in place.

The head of the set screw, locking the lamp in place, is a peculiar triangular shape, deeply recessed, so that it cannot be reached with tools.

There are no other keys on the market just like this, so it is not possible for it to be operated with an old style watch key.

THE KEY

The key is sold separately from the socket, and is only sold to those properly entitled to possess one.

Their distribution is safeguarded in every possible way.

THE PRICE

The additional cost for the Shurlok locking attachment applied to any of the regular P & S socket is small, particularly when you bear in mind the security it affords to the lamps, shades or reflectors; because with the lamp locked in place, the reflector cannot be removed.

In ordering specify the trade number of the socket or receptacle you desire, and add the words WITH Shurlok LOCKING ATTACHMENT.

This device is meeting with the instant approval of Central Stations, Contractors and Jobbers.

It is fully approved by the National Board.

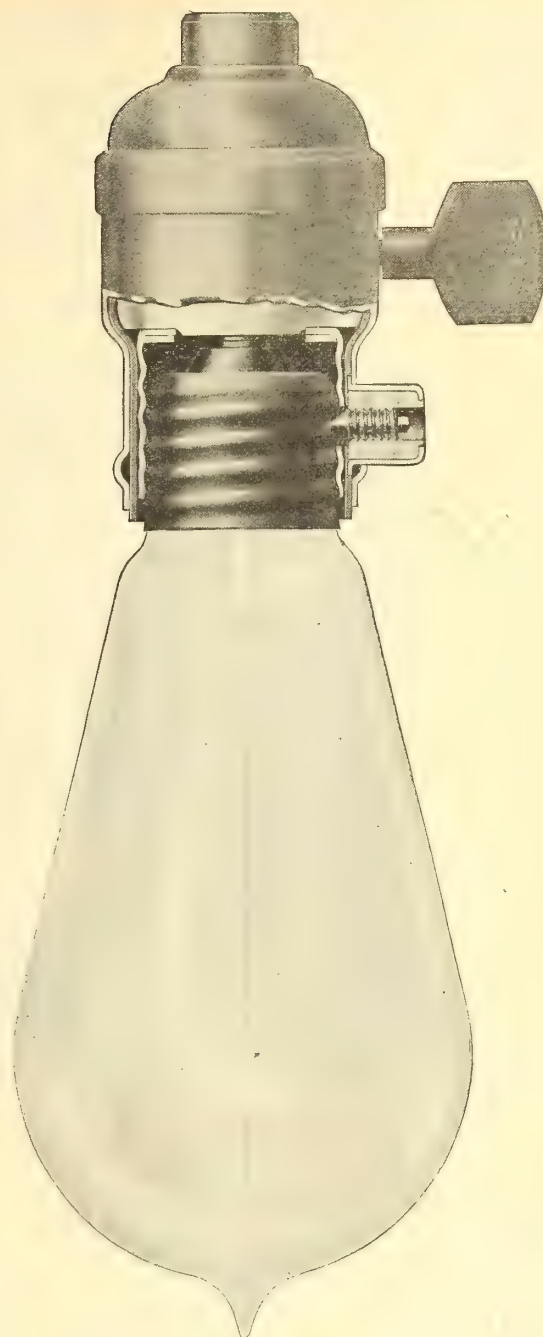
We will have a representative at the Ottawa Convention, who will be glad to demonstrate the socket, and give you any additional information you require.

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The complete equipment of the central office consists of :

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Electrical News

Generation, Transmission and Application of Electricity

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Orders for advertising should reach the office of publication not later than the 20th day of the month preceding date of issue. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

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Toronto, June, 1912

No. 6

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The Public Service Commission

Now that the Public Service Commission under one name or another is coming to be a recognized factor in the general control of Canada's big utilities it becomes a matter of the utmost importance that the personnel of these bodies should include such men as will insure intelligent, prompt and economical solution of the problems that daily arise in connection with the various phases of engineering work. To this end every such board should include one or more trained engineers.

It is a mistake, being too generally made, to assume, for example, that the man who happens to be mayor of a town or city for the time being is therefore capable of serving on a board of commissioners required to deal with questions often as foreign as possible to the business experience of the mayor in question. It is no reflection on any man to say that he is incapable of dealing intelligently with a certain problem. This is an age of specialization, and his worship may be a brilliant success in medicine, law, manufacturing or other line without in the slightest degree being capable of dealing with an engineering problem. The same argument applies equally to other members of the board. What would we say of an electrical engineer who would undertake the defence of a legal case involving questions of complicated jurisprudence or the cure of a disease requiring an intimate knowledge of human anatomy. Yet the work of the engineer is no less technical, and the fact of its being attempted by commissions lacking the necessary technical training should appeal to us in the same ridiculous light.

* * *

And not only is the average commissioner unfitted by experience and training for the work thrust upon him but he, of necessity, lacks interest in engineering work either from the economic or artistic point of view. Being a medical practitioner, he is absorbed in medicine, or a lawyer, he is chiefly interested in law; or a manufacturer, he is intent on raising the standard of his product that he may be able to compete with others in the same line of trade. On the other hand the engineer, who both by choice and by daily experience keeps himself closely in touch with the very conditions the public utilities commissions are created to control, would as a member of such a body be of inestimable value in pointing the way and avoiding the numberless and needless mistakes so often made.

It may be argued that we should be grateful to these philanthropists who give so much of their time, often without recompense, in an endeavor to serve the public, but it is well to remember that a man may also be a great philanthropist in that he recognizes his limitations and refuses to undertake duties for which others are available and better fitted.

* * *

At the recent annual meeting of the American Society of Consulting Engineers, a body having enrolled among its members many of the best known engineers in North America the question of having the engineering profession represented in the membership of the Public Service Commission of New York state was discussed. In the course of his remarks, Mr. E. L. Corthell said: "Technical questions involving the expenditure of hundreds of millions in engineering construction are in the hands of laymen, usually men of ability but generally not versed in the matters pertaining to the plans, construction and operation of works of many kinds. I believe there could be found many engineers well qualified to sit at a Board alongside of the best business men of the community and their sound judgment, sterling integrity and business as well as professional ability would give a higher tone and greater efficiency to the operations of the Commission."

On the same subject Mr. Rudolph Hering also spoke in part as follows: "It has been too common in our country, as distinguished from European countries, to see the engineering profession left somewhat in the background when the first considerations are given to the establishment of new public works. Instead of finding representative members of the engineering profession who by their special knowledge and experience are specially well fitted to pass upon questions of the practicability of public works, as regards their most efficient design, operation and economical cost, the adjustment of practical means to ends and the ascertainment of investment values, we generally find on such commissions men prominent in commercial pursuits or in the legal profession. While such men generally bring to bear upon the question arising in projecting works, excellent experience within their special activities, there is too often a lack of those important qualifications which can secure the best financial results and the best permanent efficiency."

Contrary to this custom in our country we find in Western Europe that engineering training and experience is paramount, not only in questions involving the construction and practical management of great public works, but also their original inception, general planning and design. While in our country we have recognized the advantages of engineering co-operation in large private enterprises, chiefly in transportation and manufacture where efficiency and economy are of great financial importance, we do not in the same degree recognize the same advantages in our public enterprises, the lack of which recognition causes wastefulness and inefficiency sometimes to an astonishing degree."

Even at the present early stage in the history of public commission control in Canada there are unmistakable signs, at more than one point, of the disastrous consequences of "wastefulness and inefficiency to an astonishing degree."

The Age of the Electric Car

It now appears that the storage battery automobile has become a formidable rival, not only for general utility work but also for speed, of the gasoline car. It has long been recognized that for such work as parcel or freight delivery or collection, the electric car possesses many advantages especially in that it carries ample power and speed capacity without the disadvantages of an excess of either; also in the fact that the energy in an electric car is being conserved when the car is either standing or coasting—a large percentage of the total trip in many cases. Simplicity of operation and control is also a strong argument in its favor when we consider the difficulty of securing sufficiently skilled and careful operators to render automobile traffic safe either to the car itself or to the general public.

As compared with these advantages, the objections that have been raised against electric automobiles for passenger work are slow speed and necessity for frequent charging. The former of these objections seems to have been removed however, inasmuch as there is now on the market a Canadian-made car which under test has given such satisfactory results as appear to justify the contention that ample speed for all practical purposes is obtainable. This car has already shown 42-45 miles an hour on the level road and has demonstrated its ability to take any average country hill at 25 miles an hour. These rates, of course, are far in excess of what gasoline cars are required to do, except in most unusual cases, either on city or country roads. Indeed this car takes the country roads, without apparent effort, at an even pace with the gasoline cars up to the full capacity of its battery which will drive about 75 miles on an average country road and considerably farther on the city streets.

To the average owner too, the reduced maintenance charges of the electric car are an appreciable factor. The actual cost of keeping the batteries charged is less than the actual cost of gasoline. The equipment is much less complicated and consequently less liable for repairs and the absence of excessive speed and destructive jarring and jolting reduces the repair bill for tires and parts to a minimum.

Our Convention Number

On account of the date of the convention having been placed earlier than usual the June issue of the Electrical News has been made the special annual convention number. Our cover design is again by the famous English artist, Mr. W. Heath Robinson, whose production a year ago resulted in so many favorable comments.

As Ottawa is the objective point of this year's convention we have endeavored to give our readers a detailed account of electrical operations in that city, not forgetting the electrical equipment of the Chateau Laurier, the handsome new hotel where the convention will make its headquarters. We have also endeavored to give some idea of the tremendous electrical activity from one end of Canada to the other at the present time, and are including reports from representative cities and towns throughout the Dominion. We believe these will be read with great interest by Canadians who feel that we are upon the threshold of an age of electrical activity far in advance of anything the world has yet seen and that Canada will be the hub of this activity. The convention program is given below. Members are reminded that ladies will be made especially welcome and provision made for their entertainment.

Wednesday, June 19th

10.00 a.m.—Opening Session.

Address of Welcome by His Worship the Mayor, at Chateau Laurier.

Minutes.

President's address.

Secretary-treasurer's report.

Correspondence.

General business.

11.30 a.m.—"The Influence of Ice on Water Power Development,"—Professor Barnes, D. Sc., F.R.S., McGill University, Montreal.

2.00 p.m.—"Recent Developments in Lamps and Reflectors,"—J. G. Henninger, Illuminating Engineer, National Electric Lamp Association.

"Distributing Systems for Outlying Districts and Smaller Plants,"—S. Bingham Hood, Toronto Electric Light Company.

Report of Meter Committee. L. V. Webber, Chairman.

Report of Commercial Committee. Thomas F. Kelly, Chairman.

Report of Membership Committee. D. H. McDougall, Chairman.

7.45 p.m.—Special Electric cars will leave Chateau Laurier for Victoria Hotel, Aylmer, where an informal dance and garden party tendered by the City of Ottawa will be held. Supper will be served at 11 p.m. and cars will be waiting for return trip at 12 p.m.

Thursday, June 20th

10.00 a.m.—"Watthour Meters—Past and Present"—C. W. Baker, Canadian Westinghouse Company.

"New Business,"—Thomas F. Kelly, Hamilton Electric Light & Power Company.

Report of Committee on Rates and Forms of Contract. Parker H. Kemble, Chairman.

2.00 p.m.—Executive Session (Class "A" and "B" Members) for Election of Officers.

2.30 p.m.—Automobile drive from Chateau Laurier to various points of interest in the city, including Government system of parks and drives, the Experimental Farm, Governor General's residence, etc. Light refreshments will be served at some point on the route.

8.00 p.m.—Banquet at Chateau Laurier for the registered members of the C. E. A. and guests, and the local committees with ladies accompanying them. Tickets will be furnished by the Secretary on application.

Friday, June 21st.

10.00 a.m.—"Power Factor—Its Influence and Effect"—D. H. Ross, Wagner Electric Manufacturing Company.

"Commercial Electric Heating" — McAllister Moore, Belleville.

"Underground Construction"—(illustrated by moving pictures) G. M. Gest, New York.

2.00 p.m.—Report of Committee on Uniform Accounting. D. R. Street, Chairman.

Report of Public Policy Committee. W. C. Hawkins, Chairman.

Report of Committee on Standardization of Line Construction. R. G. Black, Chairman.

Naming of Standing Committees.

Next Place of Meeting.

Unfinished Business.

3.00 p.m.—Special electric cars will leave Chateau Laurier for baseball grounds where a game will be played between two C.E.A. teams, one representing the Manufacturers, and the other the Operating Companies.

8.00 p.m.—Smoking concert in the Chateau Laurier.

The Engineer's View as Compared with the Manufacturer's—An Argument for Fair Wage Compensation

By W. B. Smith, E.E.

Canada with her many undeveloped water-powers today has helped to solve the problem; "How to reduce manufacturing costs to a minimum." As an example, in one of the large cities of the United States where electric power is generated by steam and controlled by one corporation, the manufacturers pay a minimum charge of \$4.62 per h.p. as against a maximum cost of \$1.80 per h.p. in Canada with water power.

Now suppose a manufacturer has been placing his money in a bank or investing it in reliable securities which are known to produce a stated annual dividend. Wishing to increase his profits he seeks to reduce manufacturing costs and re-invests his money; this time in a private electric plant. By this investment he saves at least the difference, for an example, between \$4.62 and \$1.80 per h.p.

When the tenders for the power plant with its motors and other accessories are called, the contract is usually given to the firm or individual naming the lowest cost, with, in a great number of cases, little regard for future value or efficiency. At this point, the manufacturer makes his first mistake. This installation, when completed, will in appearance be highly satisfactory, in that there is practically no difference to the untechnical eye between a cheap unreliable piece of electrical apparatus and the most expensive but better constructed and thoroughly reliable type.

However the firm installing the apparatus rarely suffers through its poor quality or imperfect installation. It may be, the contract calls for a month's successful operation of the equipment before it is taken over by the owner. During this period, skilled, well paid operators are employed at salaries up to \$200 per month with superintendents still better paid. The result is that the apparatus is handed over in good working order.

The private manufacturer now makes his second mistake. In sharp contrast to the plan followed by the firm installing the equipment he engages an operator at a maximum wage, of say \$75 per month, a man who is to bear the same relation to the manufacturer's investment as the officials of a bank in which the cash was originally deposited. This operator has, as part of his duties, the care and operation of water wheels and governors as well as generators and switch-boards. Surrounded by this condition, the manufacturer expects his engineer to earn him a good dividend by uninterrupted power production at a greatly reduced price over steam.

Accidents are bound to occur with all apparatus. When the plant was in the care of the firm that installed it and of their well-paid efficient engineer, continuity of service was obtained because each day the apparatus was inspected, little defects were noticed and repaired or reported and generally the plant maintained at its highest state of efficiency. An experienced operator, having nothing to do but his own work, notices that, for example, the thunderstorm of the early morning has disabled one of the main transformers. He immediately throws the necessary switches, cuts out the disabled apparatus and when starting time for the mill or factory arrives, he can at least operate at 2-3 of his full capacity. The electrical man ought not to be obliged to keep his ears on the wheels and governors, one eye on the generators and the other eye on the switch-board as is the common custom. And not only is the average operator required to attend to too much equipment, but he is often inexperienced. By some means which he cannot explain, he loses the load on one machine while trying to put two machines together on the line; the motors stop, lights go out and so on; a paper on a paper machine breaks; a lathe tool sticks in the metal it is cutting spoiling the piece; a press cylinder running on color, stops allowing the color to overflow, and many other incidents, the result too often of nervous or inexperienced hands. This all means not only additional expenditure for repairs, but at least an equally great loss in that the continuity of service is broken.

Another point that is well worth considering is the insurance. When the plant is originally installed, the rate was low. As time goes on the inspector finds loose wires, apparatus mechanically injured and so on and the rates are raised. This again reduces the dividend to the manufacturer.

An inexperienced man at a low wage may show a very pretty cost sheet as far as wages paid go, but it does not balance favorably when compared with reduced output, frequent repairs, shut-downs and so on. The efficiency sheet at the end of the year shows where the dividend has gone. Why is it that when the manufacturer exercises the greatest care in all his financial matters,—banks must be safe and operated by men of known financial ability; bonds must be gilt edged—why will he invest thousands of dollars in electrical apparatus with the hope of increasing his dividends and then place it in the keeping of men at a salary probably lower than a junior clerk in the bank would receive. Like any other plant, an electrical plant requires a high standard of technique and brains to operate it and these cannot be obtained for \$75.00 per month.

Electrical Canada from Coast to Coast

Universal Progress and Development—East Vieing with West in Modern Construction, Capable Management, Continuity of Service

VICTORIA

During the past two years, considerable changes have taken place in the matter of civic improvements in Victoria, B.C. Some fifty miles of asphalt pavement has been laid, and practically the whole of the residential streets have been boulevarded and planted with trees, as a result of which, together with very material

progress made in ornamental post and magnetite arc lighting, Victoria promises, within a very short time, to be the cleanest and best lighted city on the continent.

The ornamental post lighting, which a year or so ago only consisted of about 80 standards, has been increased to date to 600, and, when the streets already passed for installation are completed, will bring the total up to 1600 standards.

The style adopted is of cast iron, 5 lights, the distance between posts 80 feet, and the method of location 4 at intersections, and the remainder opposite. The lamp used is 8 volt, 50 watt tungsten, with 12-inch frosted globes; the lamps all burn till midnight, and alternate posts all night.

The system is fed by underground cable throughout. The installation is paid for by the property owners benefited, and the current is supplied by the B. C. Electric Railway Co. Ltd. to the city station, and paid for by the city on a kilowatt hour basis.

In addition to the progress made in the ornamental post system, the general arc lighting has also been brought up-to-date. There are now 695 arcs in use, comprising 475 magnetite and 220 a.c. enclosed arcs, with several hundred more magnetite arcs on order for extensions. There have also been erected on Victoria's favorite marine drive, the Dallas Road, near the entrance and the outer wharf, 22 magnetite arcs on steel poles, 350 feet apart, and fed underground. These lights give a very pleasing and efficient lighting effect. The cuts shown indicate that two types of lamp standard are used and the Vancouver street view illus-

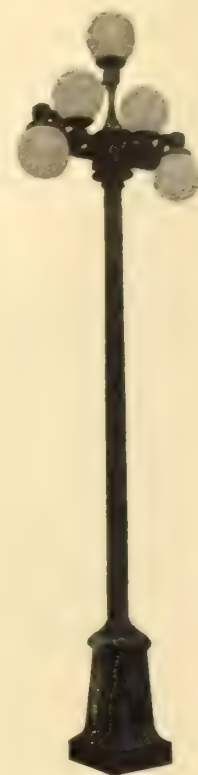
trates the generous treatment the citizens are receiving.

The entire work of the various systems has been laid out and supervised by Mr. M. Hutchison, the city electrician, to whom a great deal of credit is due for the manner in which the work has been carried forward.

At the present time, plans for lighting the "Gateway" (the inner harbor) to the city are in course of preparation by Mr. S. J. Halls, manager of the light and power department of the B. C. Electric Railway Company, and Mr. Hutchison. This scheme, when complete, will be a comprehensive one, and includes outlining the causeway retaining wall, as well as greatly improving the illumination of the causeway itself and vicinity and adjacent buildings. A slogan electric sign is also contemplated, bidding "Welcome to Victoria, Pacific Gateway of Canada."

Recently the new contract, entered into by the city council with the Vancouver Island Power Company for the supply of power, came into effect and a substantial reduction in the rates for domestic lighting previously charged by the city has been made. The Vancouver Island Power Company is a subsidiary of the British Columbia Electric Railway Company and has under construction a fine hydro-electric plant on the Jordan river some forty miles out from Victoria. This plant will be completed as the requirements of the city and the street railway service demands it. At this point there is sufficient power for an ultimate electrical installation of 40,000 h.p.

The electrical equipment in this station is of Allis-Chalmers-Bullock manufacture and the turbine was installed by the John McDougall Caledonian Iron Works Company.



One Type of Victoria Standard



A Typical View of Victoria City's Ornamental Lighting System—Vancouver St.

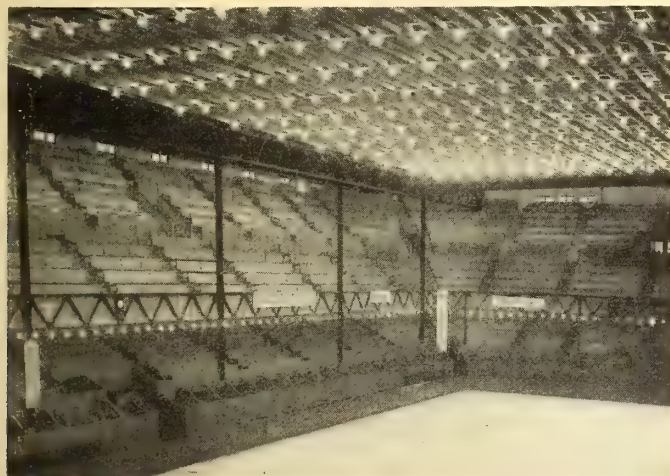
V A N C O U V E R

The Vancouver Board of Trade in conjunction with leading officials of the B.C.E.R. Company, extended a welcome on May 15th to a party of executive officers of the American Electric Railway Manufacturers' Association, who left New York on April 17th, on an 11,000 mile trip. The party journeyed through the Southern States to the Pacific Coast, then up the Coast to Vancouver, the only Canadian city to be visited. The party was headed by Mr. Thomas McCarter, of Newark, New Jersey, president of the Association, and other members were: Gen. G. H. Harris, Louisville, Ky.; C. N. Black, San Francisco; C. E. Loomis, Allen, Syracuse, N.Y.; O. T. Crosby, Wilmington, Del.; James H. McGraw, New York; C. E. Peirce, Boston; H. C. Dock Donecker, New York; Arthur Warren, New York; E. M. Williams, Cleveland, Ohio.

The programme arranged for the visitors' entertainment included a visit to the mayor, and a motor trip through the city after which they were entertained at luncheon at the Vancouver Club. In the evening President McCarter delivered an address on "Electric Railway Transportation" in the Board of Trade rooms; representatives of the governing bodies of Vancouver and adjacent districts and the various boards of trade were in attendance. The party left at midnight for Seattle, making the return journey to New York by way of the northern central states.

Proper Illumination of Skating Rink

The British Columbia Electric Railway Company was last winter requested to devise the illuminating scheme for the Arena Ice Skating Rink in Vancouver, B.C. The difficulties connected with the proper illumination plan for this building were many and great. The reflective factor in connection with the large ice surface had to be taken into account, the great height at which the lamps were placed



Vancouver Arena Lighting System

also made the problem no easy one, and, in addition, as the ice was used for championship hockey games, there was an absolute necessity that the illuminating scheme should be so arranged that there was no shadow on the ice, in order that the puck might be seen readily in an instant at any stage of the game.

The illuminating engineer of the company carried out his work so well that the result is a veritable triumph. During the winter the championship games of the B. C. Hockey League were held in the rink, and a series of games between the crack hockey players of Eastern and Western Canada was run off at the close of the season. The hockey

players declared that the illuminating plan followed was ideal, there being an entire absence of shadow on the ice, enabling the puck to be followed at every stage of a fast game.

The outside dimensions of the rink are 330 by 240 feet, the ice surface being 210 by 85 feet. In addition to illuminating the ice surface, provision had also to be made for lighting the promenade and boxes, thus making a total area of 242 by 118 feet to be covered, the seating capacity of the rink being from 9,000 to 10,000.

The ceiling of the rink is 60 feet in height and it is believed that never before was an attempt made to light such a large area from such a great height by this method of lighting. The lights were placed along the 16 beams of the ceiling, 22 on each beam at an approximate distance of 5 feet 4 inches apart. One hundred watt osram tungsten lights were used, 352 being placed as above noted. These were equipped with No. 9057 Holophane concentrating reflectors which gave from 500 to 600 candle power on the tip. The lighting scheme for the rink was planned by Mr. K. A. Auty, chief illuminating engineer for the company.

B. C. Electric Company Section N. E. L. A.

At the last meeting of the B. C. E. R. Co's section of the N. E. L. A. Mr. Woodroffe, Vancouver city electrician, read an interesting paper on "Arc Lighting." In his paper, Mr. Woodroffe first gave a brief history of the development of the arc lamp from the old type open d.c. lamp to the modern flame and luminous arc. A short account of what light consists of was followed by a complete account of the fundamental principles of the flame and luminous arc lamp. It was shown that the flame and luminous arcs are much more efficient than the carbon arc and incandescent lamp, owing to there being a direct conversion of electrical energy into light in these lamps instead of in an indirect way through the medium of heat in the carbon and incandescent lamp. It was also shown that while in the carbon and incandescent lamp the efficiency depends on the temperature, in the luminous and flame arcs the efficiency is a function of the light giving material which is introduced into the arc flame.

The question of the kind of lamp to be used for various classes of work was gone into carefully and the tungsten cluster system with ornamental pillars for street lighting discussed. There was a keen discussion after the paper in which most of those present took part. A vote of thanks was heartily voted to Mr. Woodroffe and the meeting adjourned.

Telegraph and Telephone Extensions

The Dominion government recently made the following grants for new telegraph and telephone lines in British Columbia: Kelowna to Penticton, \$7,000; Atlin to Hazelton, \$3,500; Bella Coola to 150-mile house through Chicoten, \$48,000; Blackwater to Fort George, telephone, \$5,000; Clinton to Quesnel, \$7,500; Fraser Lake to Omenica via Stuart Lake, \$3,000; Gabriola Island and entrance to island light-house, telephone line, \$1,275; Hornby Island and Denman Island to Union wharf, \$900; Lillooet to Pioneer Mines, extension, \$13,600; Malahat across Saanich Inlet, laying cable, \$2,000; Quesnel to Barkerville, \$3,500; Quesnel to Hazelton, \$3,500; Edgewood to Nakusp, telephone line, \$6,100; Lower Nicola to Canford, telephone line, \$1,000; Powell River to Vancouver, telegraph line, \$27,400.

The Sixth Congress of The International Association for Testing Materials will be held in The Engineering Society's Building from September 2 to 7, 1912, at 29 West 39th street, New York city.

Making Annual Inspection

Mr. T. Blundell Brown, London, Eng., one of the directors of the B. C. Electric Railway Co., arrived in Vancouver recently, and will remain in the city for several weeks. Mr. Brown is making a general inspection of the B.C.E.R. Company's plant and works at all points—this is in accordance with the policy of the company to have at least one of the directors visit Vancouver each year. On his trip across the continent Mr. Brown stopped off at several of the larger cities, where he noticed various innovations in electrical transportation, which he is submitting to the head staff here for consideration.

Over 5,000 Employees

The rapid growth of the undertaking of the B. C. Electric Railway company is shown by figures recently compiled. In 1901 the number of employees was about 260; in 1906 the number had increased to 550; in 1911 3,500 was the number, and at the present time the payroll shows over 5,000 employees. The office staff consists of 619 persons, with salaries amounting to \$61,102 monthly. The total payroll for the company for March last was \$391,255, and for Vancouver alone the payroll was \$184,277 for the same month.

Rapid progress is being made by C. C. Moore & Co., of Seattle, on the installation of the 4,500 kw. unit at the B. C. Electric company's steam auxiliary station at Vancouver. This will give the company 20,000 h.p. at its auxiliary plant. In the work of increasing the equipment at the Vancouver sub-station a 2,000 kw. motor generator set has just been placed in service. Work is now proceeding on the installation of another 1,500 kw. motor generator set.

The position of local manager of interurban lines has been abolished. Mr. W. H. Elson has been appointed in charge of districts one and four. Mr. E. Sterling now has charge of districts two and three, while Mr. J. P. Rannie has been appointed traffic agent in charge of Vancouver city and suburban lines.

Announcement was made recently that the B.C.E.R. Co. would build a new line on 16th avenue, Vancouver, the southern boundary of the city, from Main street to Oak street. This line will connect with the company's line on Oak street already built.

The B.C.E.R. Co. has awarded the contracts for the grading of its line on Nanaimo street, Vancouver, from Hastings to Broadway, a distance of one and a half miles, and also for the double tracking of the Fraser Valley line in South Vancouver.

Mr. J. A. Roosevelt, assistant general manager in charge of the transportation department, has resigned. Mr. Allen Purvis has been re-appointed manager of the interurban lines of the company, with headquarters at New Westminster.

An electric railway six and one-half miles in length is to be built by the Canadian Collieries Co. from the Trent River to the new mine to be opened up in the Comox district, Vancouver Island.

Citizens of Revelstoke are agitating for the establishment of an electric street railway.

N E L S O N

The cuts shown are views of Nelson's municipal power plant at Upper Bonnington Falls on the Kootenay River, 10 miles below the city.

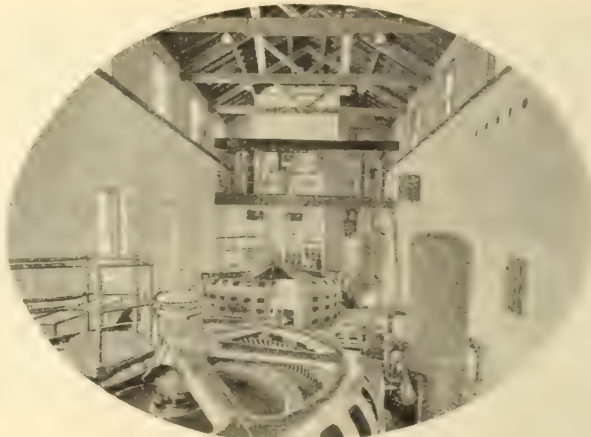
At this point there are two power plants, on opposite sides of the river, the second plant being the property of



Nelson, B. C. Power Plant

the West Kootenay Power Company which serves the smelters, large mines and towns of the West Kootenay and Boundary countries. In the city plant two generating units of the vertical type are installed, 750 kw. and 1000 kw. capacity respectively. The plant is designed for an ultimate development of 5,000 h.p. Power is stepped up to 12,000 volts for transmission over the 10 mile line to Nelson. Operation is under approximately a 60-foot head.

The Kootenay river from Nelson to its junction with the Columbia is rich in water falls. All eastern British



Bonnington Falls Plant—Nelson

Columbia may be said to be its water-shed. For hundreds of miles the Kootenay river is navigable and all its lower length constitutes practically a long narrow lake 220 square miles in area. From Nelson to the Columbia is only 23 miles and the drop in that distance is 390 feet. Of this fall 280 feet occurs in an eight-mile stretch where five separate water powers are said to be commercially possible of development,—Granite Rapids rated at 12,000 h.p.; Beaseley Gorge at 7,000; Upper Bonnington Falls at 43,000; Lower Bonnington Falls at 23,000; and Kootenay Falls at 45,000; a total of 130,000 h.p.

The West Kootenay Company has two plants. At the Upper Bonnington they develop 16,000 h.p. and at the lower falls 4,000 h.p.

C A L G A R Y

Electrical matters in Calgary are controlled by a Board of Commissioners with Mr. A. G. Graves as chairman. The efficiency of this commission is indicated by the harmonious cooperation of the various departments as well as by the splendid service rendered and large profits shown each year.

The supply of electricity for the city of Calgary is at the present time derived from two sources, hydro-electric and steam. Power is supplied to the city by the Calgary Power Company from their water power plant at Kananaskis Falls. This plant is situated on the Bow river about 50 miles west of Calgary. At this plant current is generated at 12000 volts, transformed up to 55000 volts and transmitted to the company's terminal station at East Calgary. At the terminal station it is transformed down to 12000 volts and transmitted to the city's receiving sub-stations at this voltage.

The city owns and operates an auxiliary steam power plant which is capable of supplying the demand for power in the event of failure of the hydro-electric supply. When completed, this plant will rank as one of the largest in Western Canada.

Engine Room

The Central Power House of the city of Calgary is situated in Victoria Park on the west bank of the Elbow River, and is of brick and concrete construction. The engine room is 136 ft. x 50 ft. and the boiler room (divided from the engine room by a fire wall) is 136 ft. x 83 ft. The roof is supported by steel truss work and the roofing material on the engine room is of fireproof construction. Great care was taken on the engine room roof to prevent sweating in the cold weather. The engine room floor, when completed, will be of concrete and steel construction. The floor steel has been supported independently of the turbine foundations to eliminate any vibration which might occur. This building is equipped with a 20 ton Whiting travelling crane.

Generating Equipment

Current for both street railway operation and for light and power is supplied from the plant. There are at present in operation d.c. units as follows:—

One 900 h.p. 3 crank compound engine coupled direct

to a 600 kw. 550-600 volt generator, 300 r.p.m. Engine built by the Robb Engineering Company, Amherst, N.S. Generator built by the Dick Kerr Company, Preston, England.

One 750 h.p. 3 crank compound engine directly coupled to a 500 kw. 550-600 volt 300 r.p.m. generator. Engine built by the Robb Engineering Company, Amherst, N.S. Generator built by the Allis-Chalmers-Bullock, Montreal.

One 1500 h.p. synchronous motor directly coupled to a 1000 kw. 550-600 volt generator, running at 400 r.p.m. This unit was built by the Dick Kerr Company, Preston, England.

There is at the present time on order, one 1000 kw.



Calgary Municipal Power Plant Building

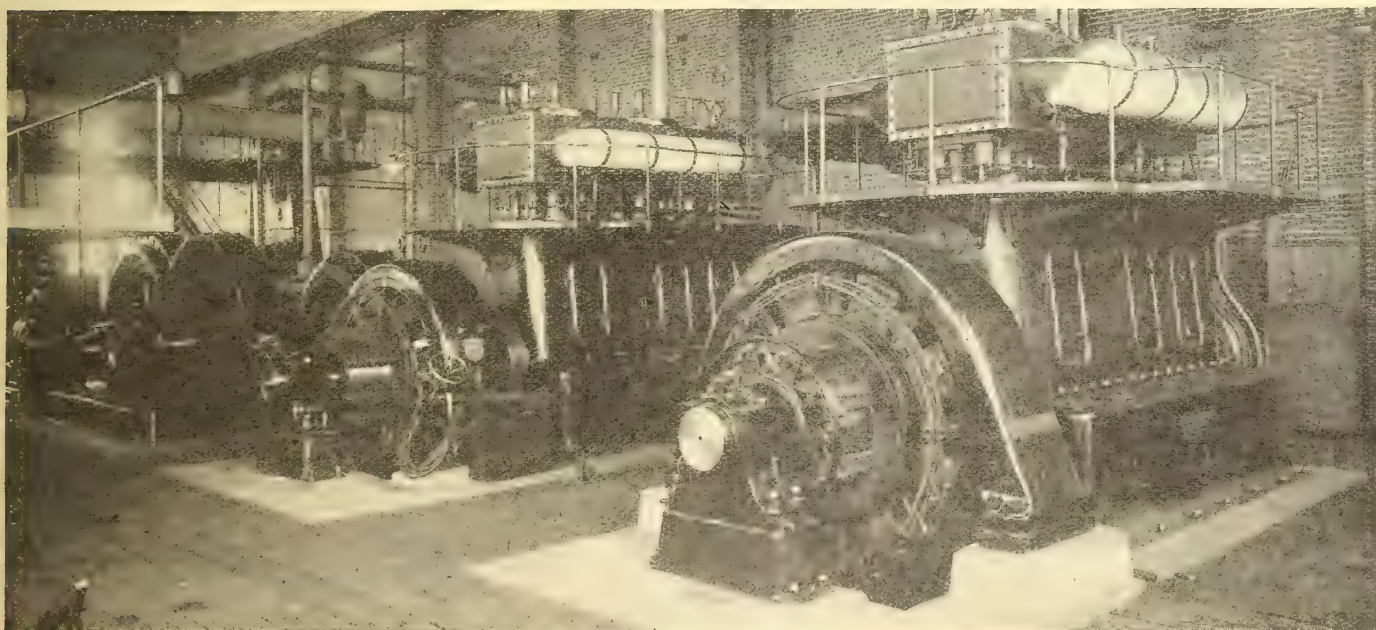
motor-generator set from the Swedish General Electric Company.

The a.c. machines consist of the following:—

One 1800-kw. turbo-generator, manufactured by the Allis-Chalmers Company, Milwaukee, Wis., 2300 volt, 1800 r.p.m. This turbine is of the "Parsons" type.

One 750 kw. 2300 volt, Allis-Chalmers-Bullock generator, driven by a 1100 h.p. cross compound vertical Corliss engine running at 120 r.p.m. Engine built by the Robb Engineering Company.

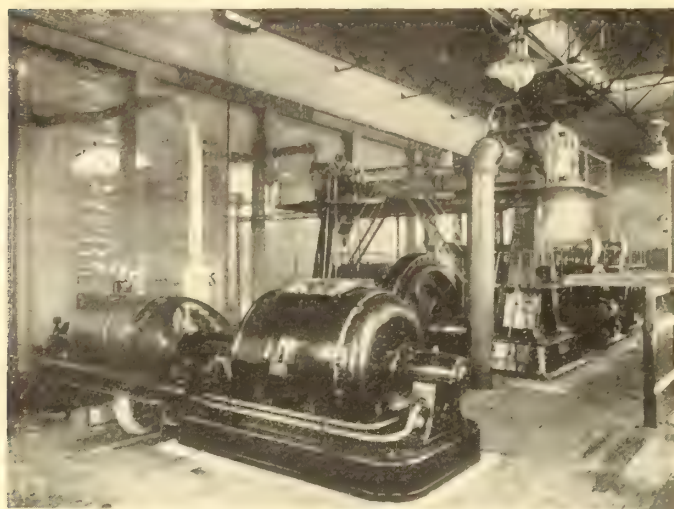
There is also on order one 2500 kw. turbo-generator



Calgary Municipal Power Plant—Interior from traction unit end—Floor incomplete

from Belliss & Morcom Ltd., Birmingham, England, connected to Vickers Ltd. generator.

Exciter units—One 100 kw. 120 volts, 290 r.p.m. steam driven unit; engine built by the Robb Engineering Company;



Calgary Municipal Plant—A.C. end

generator by Canadian Westinghouse Company. One 50 kw. 120 volts, 290 r.p.m. steam driven unit; engine built by Robb Engineering Company; generator by Allis-Chalmers-Bullock. One 100 kw. motor-generator, 120 volts, 520 r.p.m.

Condensers—The condensers for the main units are of the surface type with the exception of the condenser on the Corliss engine. This unit is equipped with a jet condenser. The circulating water is at the present time supplied by an 18 inch pipe line. The intake for this line is situated on the Elbow river about one mile above the power house. Sufficient fall is obtained in this distance for the water to circulate through the condensers by gravity.

There is now being installed a five million gallon centrifugal pump to supply circulating water direct from the river in case extra water is required.

Switchboard Equipment

The main switchboard is mounted on a concrete and



Calgary Municipal Plant—Switchboard and Gallery

steel gallery 70 feet x 12 feet supported on iron columns. The switchboard consists of 19 panels. The d.c. board has three generator panels and three feeder panels, with two feeders on each panel. The a.c. board has four generator

panels, three exciter panels, one hydro-electric control panel, three feeder panels, and two arc lighting control panels. This board is equipped with all the usual standard instruments, together with recording wattmeters, power-factor meters, frequency meters, etc. The voltage is controlled by a Tirrill regulator. The steam units can be operated in parallel with the hydro-electric lines and by a system of auxiliary bus-bars can be operated independently.

The Boiler House

The boiler plant consists of 16 Babcock and Wilcox water tube boilers, 12 of 3580 square feet of heating surface, and 4 of 2823 square feet of heating surface. These boilers are all equipped with B. & W. super-heaters and B. & W. chain grate stokers. The main steam heater and steam piping was supplied by the B. & W. company.

Draft plant—The induced draft plant consists of two 106 in. fans coupled direct to two 10 in. x 10 in. vertical centre crank engines and a steel stack 8 ft. diameter, 75 ft. high, and two 120 in. fans coupled direct to two 10 in. x 10 in. horizontal side crank engines with a steel stack, 8 ft. diameter, 75 ft. high. The flues are all underground.

Coal and ash handling machinery—The coal is unloaded from the cars into a 20 ton hopper outside the



From left to right—James McColl, Supt. Power Plant, Commissioner A. G. Graves, R. A. Brown, Supt. Light and Power—Calgary

building. It is conveyed from this hopper by a tray conveyor on to the main bucket conveyor. The bucket conveyor dumps the coal into a steel bunker which has a capacity of 600 tons. The same conveyor is used to take away the ashes. These are loaded into the bucket conveyor on the conveyor tunnel and dumped into a tray conveyor which discharges them into an ash bunker of 15 ton capacity. The coal handling apparatus was manufactured by the C. W. Hunt Co. and supplied and erected by Phillips Land & Co., Chicago, and is capable of elevating 50 tons of coal per hour.

Receiving Sub-Station

Current is transmitted from the terminal station of the Calgary Power Co. to the sub-station of the municipal plant at 12000 volts. It is transformed to 2300 volts in the city's sub-station and delivered at the main switchboard. This sub-station is a brick building adjoining the main power house and contains three 1000 kw. transformers together with all necessary switching gear and electrolytic lightning arresters.

All cables entering the sub-station and main power

house are underground and in this respect Calgary is in advance of most Canadian cities.

The phenomenal growth of Calgary during the last five years has necessitated large and important extensions to supply commercial demands for light and power, also power for the operation of the municipal street railway system. The civic power plant started operation in November 1905 with 1 unit of 260 kw. capacity, and since that time it has been necessary to practically double the capacity of the plant each year.

Mr. James McColl, superintendent of the power department, was appointed in 1905 and has remained with the city ever since. The plans for the new power house were prepared by city engineer J. T. Child, and the construction of the same was under the supervision of superintendent McColl of the plant, who also arranged for the erection of the necessary machinery, etc.

The light and power distribution department is superintended by Mr. R. A. Brown, who was appointed to the post in December 1911 and was entrusted with the reorganization of same, which has been carried out most satisfactorily to the Commissioners. At the present time this department has 8000 customers and the estimated gross revenue for 1912 will be approximately \$400,000.

The street railway system in Calgary is also under municipal control and is justly considered one of the most efficient and best managed roads on the continent. As in the other departments large additions have been necessary from year to year to keep pace with the city's growth, and this year the expenditures will be very large. Mr. Thomas H. McCauley is superintendent of railways.

PRINCE ALBERT

In conjunction with the extensive plans which the city of Prince Albert, Sask., has in hand, for a hydro-electric power development at La Colle Falls, considerable improvements and extensions are being made to their present steam plant within the city. One 632 kv.a. Westinghouse generator is being installed, coupled to cross-compound Goldie-Corliss engine, and this outfit will supplement the present equipment consisting of one 75 kw. Allis-Chalmers-Bullock generator, belted to a Goldie Ideal engine and one 260 kw. A.-C.-B. machine direct connected to one 150 r.p.m. cross compound Goldie-Corliss engine. During the winter of 1911, and in the month of December, a peak load of 260 kw. was carried at 85 per cent. power-factor and it is fully expected that during the coming winter 600 kw. will be the approximate peak load. The necessity of extension is therefore readily understood, and in view of the further enquiries for power that are constantly being received the city may be led to install an additional 2,000 kw. turbo-alternator set at an early date.

The Westinghouse switchboard when completed, will consist of five panels made up of two generator panels, two load panels and one extra panel, which latter will take care of two separate exciters in connection with Tirrill regulators. A double set of bus-bars is arranged, power and lighting circuits being kept separate as much as possible to secure better control of circuits in emergency cases.

The boiler capacity is supplied by four Goldie return tubular boilers with total capacity of 800 h.p., and three Canada Foundry water tube boilers of 400 h.p., while a new battery of water tube boilers will shortly be installed.

Owing to the scarcity of coal in this district, jack pine at \$4.50 per cord has formed the fuel supply. This has proved an excellent material for firing purposes, but it has been decided to revert to coal, cutting out the extensive handling required with wood as fuel.

All the steam machinery is run condensing with the circulating water obtained from the North Saskatchewan River close at hand. The city water pumping plant is also operated in conjunction with the steam system and it is largely due to the careful management and economical methods of pumping and condensing that the plant is on a paying basis and has shown a steady profit during the past few years.

Eighty 6.6 ampere Westinghouse enclosed series arcs with about twenty 100-watt series tungstens at present form the street lighting. The connected motor load is approximately 250 h.p., and this it is expected will be rapidly augmented. A new pulp mill will probably require 5,000 h.p., and a lumber mill is expected to take 1,500 h.p. Low power rates are offered. During 1910-1911 a power rate of 8c. per kw.h. was in force with a sliding discount to 40 per cent. for monthly consumption up to 1,000 kw.h. This year they have 6c. per kw.h. as a base rate, with a sliding scale averaging as low as 2½c. per kw.h. for consumption up to 5,000 kw. As a result of this low rate, the power load is an important factor, and a large number of enquiries are constantly received from prospective customers. The lighting rates have also been regularly reduced; to 10½c. per kw.h. during 1910; in 1911 to 9½c. per kw.h., and this year to 8c. per kw.h., less 5 per cent., 10 per cent. and 15 per cent. discounts, according to consumption, with an extra 5 per cent. cash discount.

While the above cuts in power and lighting rates have been effected, the steam plant has still shown a splendid balance sheet, and during the last three years, upwards of \$21,000 profits have been made, after taking care of all incidental expenses and depreciation charges. Mr. R. Wright is electrical superintendent, with Mr. O. A. Klein, chief engineer of the power house.

The hydro-electric development for the city of Prince Albert at La Colle Falls on the North Saskatchewan river is now under construction. The contract for the concrete headworks has been let to the Ambursen Hydraulic Construction Company of Montreal, for \$578,000. The headworks include the dam, a navigation lock 40 x 150 feet, 6 feet deep, and the intake works. A power canal, excavated in boulder clay leads from the headworks to the power house half a mile below the dam. The head obtained will be 30 feet, and with the water available during minimum flow 12,000 horse power can be produced. The turbines will be of the vertical type. Six units will be eventually installed, and two immediately, the generators being each 2,000 kv.a. capacity. Power will be transmitted to Prince Albert at 35,000 volts and stepped down to 2300 volts in the local receiving station.

The hydro-electric plant will cost about a million dollars, and will be completed in less than two years. The whole undertaking is being financed by the municipality of Prince Albert for whom C. H. & P. H. Mitchell are the engineers.

LETHBRIDGE

Active construction commenced on the municipal street railway on April 8th, and since that time about four miles of track have been completed. The city contemplates laying a total of ten and a half miles of single track, and expect to have this complete and ready for operation in time for the annual fair early in August. The "Thermit" process of bonding is being used and all rail joints are being double bonded, using a 4/0 stranded copper bond. Five single truck cars and five double truck cars at present are on order with the Preston Car & Coach Company, of Preston, and these cars are being equipped with Westinghouse double and quadruple motor equipments arranged for single end control.

In the business district the overhead construction is supported on steel poles on which will be mounted a cast iron bracket carrying four 150 watt tungsten lamps enclosed in 12-inch alba globes. These poles are spaced 90 feet apart on both sides of the street. The wiring system will be three-wire 220-110 volt a.c., controlled by time switches. The overhead material is being supplied by the Canadian General Electric Company, the Northern Electric Company, the Eugene F. Phillips Company, and the Ohio Brass Co.

The car barn is located in the south end of the town and is designed for a combination car barn and sub-station. The sub-station will be equipped with one 200 kw., 600 volt, d.c. interpole generator and one 400 kw., 600 volt, d.c. interpole generator, driven by 2200 volt, 2-phase, 60-cycle, self-starting synchronous motors, designed to correct the power house power-factor from 80 to 95 per cent. 2200 volt, 2-phase, 60 cycle current will be supplied to these motor generator sets from the power house located on the river bottom lands, about half a mile from the sub-station.

Additions are being made to the present power house equipment to take care of this additional load. The new unit consists of one 1500 kv.a. high pressure turbo-alternator supplied by Messrs. Willans & Robinson, of Rugby, England, together with complete condensing equipment, all auxiliaries being motor driven. Excitation is being taken care of by a steam driven unit of 50 kw. capacity. The engine is manufactured by Messrs. Belliss & Morcom, and the generator by Messrs. Siemens Bros., of Stafford, England. An additional 1200 h.p. in Babcock & Wilcox water-tube boilers is being installed in the boiler room, together with small additions to the coal and ash conveyor. A Weir's feed pump supplied by Messrs. Peacock Bros., of Montreal, is also being added. The boiler room is being considerably enlarged to accommodate the additional boilers and a switch room is being added to the engine room. Work on these extensions is progressing very rapidly and a large amount of material is at present on the ground and being installed. The building will be complete in about six weeks and it is expected the machinery will be in operation not later than August 1st.

The motor-generator sets for the street railway sub-station are being supplied by Messrs. Siemens Bros., who are also supplying the complete switchboard equipment. A new economizer is being installed, also two induced draught fans and engines to take care of the additional boiler horse power. These are all being supplied by the Green Fuel Economizer Company, Matteawan, N.Y. All steam and feed water piping is being manufactured by Crane & Company, Chicago, who are also supplying all valves.

This extension work is being carried out under the direct supervision of Mr. Arthur Reid, general superintendent of Light, Power and Street Railways for the city of Lethbridge.

REGINA

The municipal plant in Regina consists of one 300 kw. Corliss unit, one 100 kw. Ideal engine with one 500 kv.a. low pressure turbine, one 400 kw. d.c. railway unit, one 1500 kw. high pressure turbine (Willans-Siemens), 2000 h.p. Babcock & Wilcox boilers, and 4000 sq. ft. Green economizers. The output for several years shows considerable increase as follows,—

In 1909 output was 1,201,160 kw. hrs.

In 1910 output was 1,567,631 kw. hrs.

In 1911 output was 2,458,535 kw. hrs.

The output for the first four months of 1912 has been running 80 per cent. above the same months for 1911.

WINNIPEG

According to the latest official figures from the City Hall records, the present population of the city of Winnipeg is in the neighborhood of 165,000 people, while in 1905 it was only 79,975. This extremely rapid growth has naturally taxed transportation facilities to the utmost to keep pace with it, but that they have done so is evidenced by the comparatively small amount of complaint as to the service given by the street car company. There is, to be sure, some crowding at rush hours, but not to the extent that will be found in most of the older cities where the growth has been at a slower rate and transportation companies have had more time to adjust themselves to the growth. The season in which work can be done on track extensions is also much shorter than in most cities, and in the past few years the number of cars that could be run over the principal streets at the rush hours has about reached the maximum limit, owing to the congestion of these streets, and particularly at the corner of Portage and Main streets, as will be shown in the following brief analysis of conditions in the city.

On reference to the accompanying map, Fig. 1, it will be seen that practically all of the car routes in that city

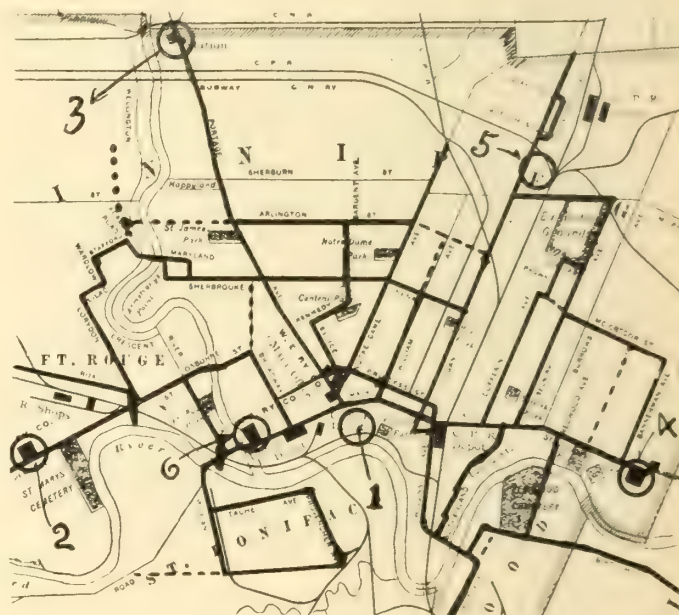


Fig. 1.—City Railways and Sub-stations—Winnipeg Electric Railway Company

converge near the centre indicated by the corner of Portage avenue and Main street and prior to the building of the Princess street and Ellice and Sargent avenue lines last year, all of the cars excepting those on William and Logan avenues and a few minor stub lines had to pass this corner. Further reference to the map will show that the Canadian Northern Railway shops, which mark one industrial centre, are in the southern part of the city, while the Canadian Pacific shops, which mark the approximate location of the second large industrial centre, are in the extreme northwestern part of the city, while the third is located on the Red River in Elmwood and on Point Douglas. A large number of the workers in these shops live nearby, but a very large number live in the district between Portage and Logan avenues, and in the populous section to the north of the Canadian Pacific Railway tracks, and known as the north end or St. Johns. This means a very heavy cross-town traffic, nearly all of which must be handled on Main street or Portage avenue.

As Winnipeg can hardly be called a large manufactur-

ing city as yet, it follows that a large share of her population must be engaged in office work of one kind or another in the many large banking and investment houses, the retail and wholesale stores, and the distributing houses for the machinery and appliances used on the farms of the great expanse of country tributary to this city. Unlike the shop workers, few of these people live close to their place of work, and they make a very heavy demand on the car service. It is, however, a more diversified load, for they



Fig. 2.—Intersection as set up at Factory

go to nearly all parts of the city, with a very heavy traffic out on Portage avenue to the suburban district of St. James and Deer Lodge. This traffic, as well as that of interurban lines of the Suburban Rapid Transit Company to Headingly and St. Charles, has been diverted from Main street and lower Portage avenue to their great relief by the Princess and Donald street line. Another line that has done a great deal to relieve Portage avenue and to give better service to a thickly populated district is the Sargent and Ellice avenue line, which was also placed in operation last year. It may be seen by again referring to the map that about the only connecting link between the business part of the city and the residential section to the north of the C. P. R. tracks is the Main street subway beneath these tracks, and this will accommodate but little more traffic. A by-law was placed before the people at the last election providing for another subway at Princess street, but this was defeated. A subway was, however, completed last year at McPhillips street, but owing to some trouble about the railway crossings of the Gimli branch of the C. P. R. beyond the Exhibition grounds, this line has not yet been completed. This line will provide much quicker service to a very large number of the people working in the plants along Logan avenue and living north of the C. P. R. tracks.

There was also completed recently a viaduct over the C. P. R. tracks a short distance east of the Exhibition grounds, and it has been proposed to extend the Arlington street car line to cross over this viaduct. This would provide an excellent cross-town service between this district and Portage avenue west, and as it has also been proposed to bridge the Assiniboine River at the end of Arlington street and extend the car lines to connect with the present lines in Fort Rouge district, this would prove an excellent connecting link between North Winnipeg and the rapidly growing residential district south of the Assiniboine.

The following are the track extensions proposed by the City Council for this year:—

Ward 1.—Double track on Academy road from Stafford to Ash street.

Ward 2.—Double track on Broadway from Osborne to

Sherbrooke; double track on Donald, Portage to Broadway.

Ward 4.—Double track on Arlington from Notre Dame to end of Arlington street bridge, Logan avenue; double track Sherbrooke to Arlington on William.

Ward 5.—Double track from Dufferin to Selkirk street on Arlington.

Ward 6.—Double track, Mountain avenue from Main to McGregor.

Ward 7.—In Elmwood—Double track from Talbot avenue on Stadacona street to Poplar avenue; double track on Talbot avenue from Kelvin road to Stadacona; double track from Stadacona to Roland street on Talbot; double track from Hespeler to Talbot on Kelvin; double track from Poplar to Union on Levis and Watt.

The holiday movement is, with a few exceptions, very well diversified, there being very popular resorts on the principal car lines to the north, west and south of the city, the principal attractions at the north being the city parks and camping grounds along the Red River, and the popular interurban line to Selkirk, 22 miles north of the city, while to the west is the large and beautiful Assiniboine Park, the Country Club, Rifle Ranges, and other places of interest, while to the south are River and Elm Parks, in the former of which is the baseball park and excellent picnic grounds, boating and other attractions on the Red River at this point. The principal exception is the Exhibition traffic in July, and this is naturally a heavy concentrated load.

No mention has been made of the district across the Red River to the east of Winnipeg. This has been coming into greater favor all the time as a residential section along the Red River to the south, and there are excellent prospects for considerable industrial development in St. Boniface and Norwood, and it is probable that a considerable number of extensions will be made in this neighborhood within the next year or two.

Owing to the vigorous movement in real estate in the neighborhood of Winnipeg, land is too high for market gardening, dairying and such like occupations, the products of which Winnipeg is very much in need. The radial lines into the country are thus of great importance to the



Fig. 3.—Double track 3-part Y, ready for concrete

city, and these at present comprise the Winnipeg, Selkirk, and Lake Winnipeg Railway, a line 12 miles long to the town of West Selkirk, and tapping a rich country along the Red River; the Birds Hill line of the Winnipeg Electric Railway, along the east bank of the Red River for about six miles; and the lines of the Suburban Rapid Transit Co.

on both sides of the Assiniboine River, one to a point about seven miles west of the city limits and south of the Assiniboine, and the other along the north shore of that river to Headingly, about fourteen miles out. With the growing importance of the Grand Trunk Pacific shop-town of Transcona as an industrial town and its need for better communication with Winnipeg, an electric line is sure to be built in the near future.

A line to the town of Stonewall, seventeen miles north-west of the city is being considered. This would provide a much better means of communication between the excellent farming and dairying section and the city than now exists. The transfer of the Agricultural College to its new site at St. Vital, twelve miles north of the city, and the many advantages offered by that section to homeseekers and truck gardeners, will result in a rapid increase in population of that section and the building of a suburban line into this section on one or both sides of the Red River.

When these lines are built, which will probably be within the next year or two, Winnipeg will have with the present lines, electric lines radiating in all directions.

For the supply of power to the various lines, there are installed or under construction the following stations at positions as indicated on the map:—Sub-station No. 1, 5,200 kw.; No. 2, 1,000 kw.; No. 3, 2,200 kw., of which 1,200 kw. in machine capacity is added this year. (It is the latter station that furnishes power for the Suburban Rapid Transit Company lines); Sub-station No. 4, 800 kw. capacity; No. 5, now building, 1,200 kw. capacity; No. 6, 1,400 kw. capacity, also under construction, and on the Selkirk line two stations each of 1,250 kw. capacity. There is thus a total of 14,300 kw. installed capacity in synchronous motor generator sets, with 2,300 volt motors except on Selkirk line, where the motors are 13,000 volt and 575 volt d.c. generators.

The Character of the Load

A very good idea of the character of the load may be secured from the accompanying curves, which also show the general movement of traffic throughout the day. As may be seen from the map these stations are located at the most important load centres, station No. 1 being located within two blocks of the corner of Portage and Main, the business centre of the city. This station is also the terminal station for the transmission line from the hydro-electric plant at Lac du Bonnet, and the principal distribution station.

No mention has yet been made of the character of track construction which is employed by the street railway company. Experts from large eastern systems have pronounced this to be of the very highest grade, and the following brief description and illustrations will give some idea of the work done. A closer inspection of the map will show that there are a large number of intersections throughout the city and these are well provided with turn-outs, so that great flexibility is assured in re-routing the cars due to changes in the traffic, and the formation of belt lines and loops is made very easy. This is quite necessary for the majority of the cars are single ended with the large rear platform. The large number of intersections has rendered necessary a large amount of special work, in fact more than is installed in any other city in Canada. There was installed last year in addition to a large amount of double track, six grand union intersections, two double track three part Y curves, and one double track three part Y curve with cross over. Of the above grand unions, two were of solid manganese, built by the Canadian Steel Foundries, Montreal; the other four built by the Lorain Steel Company, Johnstown, Pa., were of manganese insert construction with solid manganese switches. The railway company expects this year to install two double track three part Y curves

with crossings, and five double track three part Y curves. A large part of this intersection work had to be installed at the busiest corners in the city, and this without disturbing traffic to any great extent. Perhaps the most difficult part of this work was the installation of one of the manganese insert grand unions noted above, at the corner of Main and Higgins, the second busiest corner in town, and perhaps the busiest from the point of vehicle traffic, for it is at this point that Main street dips into the subway under the C. P. R. tracks. Temporary tracks were laid on planking at one side of the street, while one section of the work was completed, and traffic was then shifted to the other side of the street. This intersection is shown in the illustration, Fig. 2, as set up in the factory. The illustration, Fig. 3, shows a double track three part Y curve with crossing as set up on the street and ready for concreting. The weight of rail used in intersections is 108

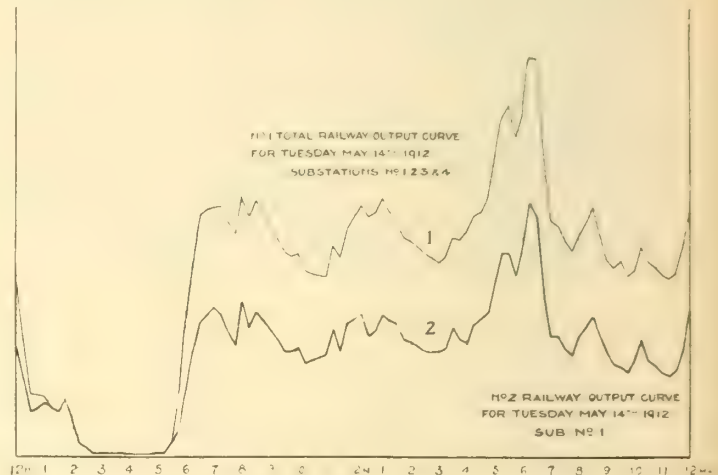


Fig. 4—Curves showing traffic movements

pound to the yard, guard rail type, while for standard track construction 80 pound tee rail is used. These set on wooden ties resting on a six-inch concrete foundation laid on three inches of broken stone. Under this is a three-inch tile drain running the length of the track. The rails are provided with stone setts, and are concreted in to a height required for the paving. Owing to the wide streets, 66 feet on the majority and 132 ft. on Portage avenue and Main street, there is a much wider devil strip than is found on most systems, the spacing between centre lines of track being 12 feet, leaving a devil strip of 7 feet 3½ inches, while on Main street the tracks are set 25 feet 3 inches on centres. The bonds used on these rails are of the electrically brazed type, the work being done by an Electric Railway Company's machine.

The rolling stock used on the lines above referred to is of the highest grade, there being 250 cars in operation on the city lines at present, including the S. R. T. line, and 9 on the Selkirk line. These latter are of standard inter-urban type and designed for speeds of 55 to 60 miles per hour.

The equipment and operation of these lines therefore compares very favorably with any other lines in the United States or Canada, and any further steps taken toward relieving the growing congestion down town and providing better transportation for the workers by means of surface cars, must be in the direction of paralleling lines on less crowded streets, and as there is ample room for these, it would hardly seem as though any elevated lines or subways would be needed for many years.

The Winnipeg municipal system will be placed under the control of the Public Utilities Commissioner.

City Pays One-third

The city of Winnipeg has adopted a definite policy for apportioning the cost of ornamental street lighting standards. The city at large will in all cases pay one-third of the cost of the ornamental standards, whether erected on business or residential streets, the individual property owners paying the other two-thirds, and having three years in which to make the payments. In connection with this it was decided to erect on Assiniboine avenue from Main to Kennedy streets and on Osborne street from Osborne Bridge to Stradbroke Place, a five-tungsten lamp type of ornamental standard. The work of erecting the ornamental standards on Portage and Main streets is proceeding rapidly, and it is expected that these will be completed and in use before the Exhibition in July.

Judge Robson the New Commissioner

It has been announced that Judge Cumberland, who was appointed Public Utility Commissioner for Manitoba, has resigned owing to ill-health, and Judge H. A. Robson, of Winnipeg, has been appointed in his stead. While it is greatly regretted that Judge Cumberland cannot serve, there seems to be universal satisfaction with respect to the appointment of his successor. The city of Winnipeg has passed through the council, without a dissenting vote, a by-law to place all of the public utilities operated by the city under the new Public Utility Commissioner.

PORT ARTHUR

The city of Port Arthur owns and operates under the supervision of Commissioner J. J. Hackney, all the franchises, including a water power development one and a half miles east from the centre of the city. The equipment here consists of three a.c. 2200 volt, 3-phase, 60 cycle dynamos, and one d.c. 600 volt, 250 h.p. dynamo, all manufactured by the Allis-Chalmers-Bullock Company; also one turbine pump, 250 h.p., manufactured by the Jenckes Machine Company, Sherbrooke, Que. These are all direct-connected to turbine wheels with Woodward governors. This power house is connected by tie lines paralleling those in the city sub-station built by the Hydro-electric Power Commission of Ontario.

The city has an agreement with this Commission to take from five to ten thousand horse power, of which at present they are taking 2,000 h.p. The equipment of the sub-station consists of six 750 kv.a. transformers in two banks. The high tension side is star connected, the secondaries, delta. At present they are using only one bank, the second being held in reserve and so arranged that they can be switched on the same bus-bars to parallel or work single to switchboards, with all necessary meters to measure incoming and outgoing power, and feeder panels with oil switches to control outgoing local circuits for power, commercial, domestic and street lighting.

This power is supplied by the Kaministiquia Power Company from Kakabeka Falls at 25,000 volts, 3-phase, 60 cycle, stepped down in the city sub-station to 2200, at which voltage it is carried on overhead lines on No. 0 D.B.W.P. stranded copper cable to any part of the city as required for power and lighting purposes.

Power

Power is supplied at 2200 volt, 60 cycle, 3-phase, a.c. at the following rates:—

Class A.—Unrestricted power, \$25 per h.p. per annum.

Class B.—Restricted power, (daylight), \$20 per h.p. per annum.

Class C.—Restricted power, summer 12 hours, winter 8 hours, at \$15 per h.p. per annum.

Class D.—Differential power, \$1.35 per month per h.p. of demand load for first 10 h.p.; \$1 per month per h.p. all in excess; plus an energy charge of 1c. per kw.h.

Commercial and Domestic Lighting

In the lighting system it is optional whether meter or flat rate is given. The commercial rate is based on installed capacity at 8c. for first kw.h. daily use, plus 3½c. for each additional kw.h., with 10 per cent. discount. The commercial flat rate is 40c. for each 60 watt lamp per month with 15 per cent. discount. The domestic meter rates are a fixed charge of 4c. per 100 sq. ft. of area lighted, with additional charge of 3½c. per kw.h., as metered, with 10 per cent. discount. The domestic flat rate is 25c. for each 60 watt lamp per month, with 10 per cent. discount.

Street Railway

The street railway within the city limits is owned and operated by the city of Port Arthur, and operated by Port Arthur in the city of Fort William, giving a ten-minute service with thirty cars and twenty-two miles of track.

Telephone

The telephone system is central energy, giving, it is claimed, the highest type of service with the lowest rate in Canada. The commercial rate for single line is \$36 per year, unlimited service. The domestic rate, single line, is \$15 per year, unlimited service. There are 2,025 telephones in service, and free connection with Fort William exchange, consisting of 1,900 telephones, and a small charge made for rural telephone service—a total of over 4,000 telephones. Wires in the business section are underground; residential section overhead.

Street Lighting

The street lighting system is tungsten clusters, composed of four lights on each pole, of 100 watt lamps capacity each, on the business streets. Streets paralleling and crossing, two on every pole with four on the corner. Residential sections, 100 watt lamp on every pole with two on the corner. Outside districts, one 60 watt lamp one every other pole. There are 1,650 lights installed at the present.

Anticipations for the Near Future

The building of a municipal power plant at Dog Lake, with 30,000 h.p. capacity, which will allow the city to sell power at a lower price; the building of about ten miles of street railway lines and rebuilding pole lines, replacing with B. C. poles; large extensions in electric light; putting a large proportion of telephone lines underground.

PORTAGE LA PRAIRIE

The installation of the new 312 kv.a., 2300 volt, 3-phase, 60-cycle Canadian General Electric generator and Goldie & McCulloch Corliss engine has just been completed and placed in operation.

Since the plant has been taken over by the municipality and 24-hour service installed, electric motors are rapidly taking the place of gasoline engines. A number of good contracts have also been recently signed, including the Stephens Brick Company for a five-year contract up to 200 h.p. and the Portage Brick and Tile Company, a new concern, on a five-year contract, up to 150 h.p. This type of load has been found to produce a very satisfactory load-factor on the plant as the brick companies operate for only the five summer months and so an equipment which is large enough to handle the peak winter lighting load can easily handle the brick industry during the summer.

The exhibition grounds will be supplied this year with electric light and power. All flat rates which were in vogue under the old company's regime, were finally discontinued on the first of May, this year.

ESPANOLA

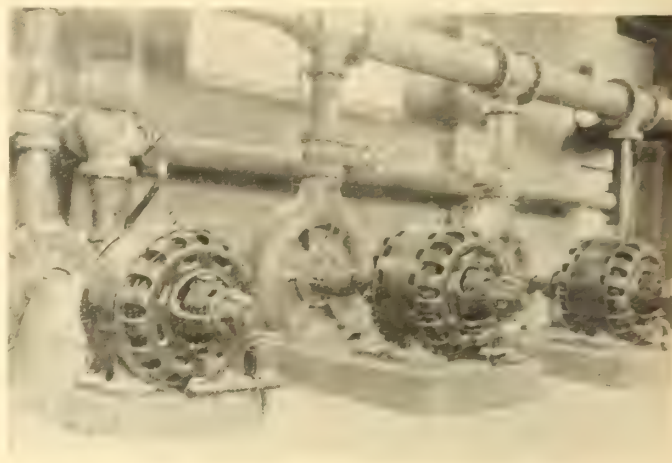
The Spanish River Pulp & Paper Mills are located at Espanola, 40 miles west of Sudbury and 130 miles east of Sault Ste. Marie on the Sault Ste. Marie branch of the Canadian Pacific Railway. The Spanish river runs through the heart of the timber limits owned by this company which comprise some 6,000 square miles. At Espanola the river runs between two promontories, creating a favorable location for the dam which is built of concrete flanked by natural rock formation on either side and providing a 60-foot head of water. The storage thus provided serves not only to regulate the water supply but also creates the necessary storage capacity for some 40,000 cords of wood which it is necessary to prepare during the winter months for supply throughout the year.

Five large penstocks convey water from this dam to the turbines which supply power for grinding the wood to pulp. A sixth penstock supplies water for three other smaller turbines direct connected to generators which supply current for operating the numerous motors used in the various parts of the plant. The five grinder turbines have 2200 h.p. capacity each. The single penstock which feeds the turbines driving the generators is 14 feet in diameter and on reaching the power house divides into three sections, one supplying each unit. These three turbine units each consist of two 30-in. diameter Hercules water wheels, 1,650 h.p. capacity, 360 r.p.m. when operating under the 60-foot head.

The penstock is 275 ft. long, the first 25 ft. being made from 5/16-in. plate, and the rest of 3/8-in. The intake is 12 ft. 2 in. wide, and 14 ft. 9 in. high with arched top. There is a 16-in. vent pipe to prevent collapsing of penstock when emptying, and an expansion joint is placed about half way down, to take care of expansion and contraction due to changes of temperature. Two 6 in. x 6 in. angle iron rings are rivetted on the pipe at each end, between these angles a 3 in. x 1/2 in. anchor stay, ends of which are embodied with the angles in large concrete anchor piers. The upper part of the penstock is carried on cast iron brackets, which are rivetted to the pipe, and set on concrete piers. The lower section is carried on structural steel, the saddles being carried on a trestle.

The three generators are of 1,250 kv.a. capacity, re-

volving field, two-bearing, water-wheel type. Two exciters are installed of 40 kw. each, belt-driven. The electric generators and all electrical equipment were supplied by the Canadian Westinghouse Company. This equipment further includes about 2,500 h.p. in induction motors, about 700 h.p. in synchronous motors, a 17-panel switchboard, black marine finish, for the power house, and a five-panel board for the sub-station.

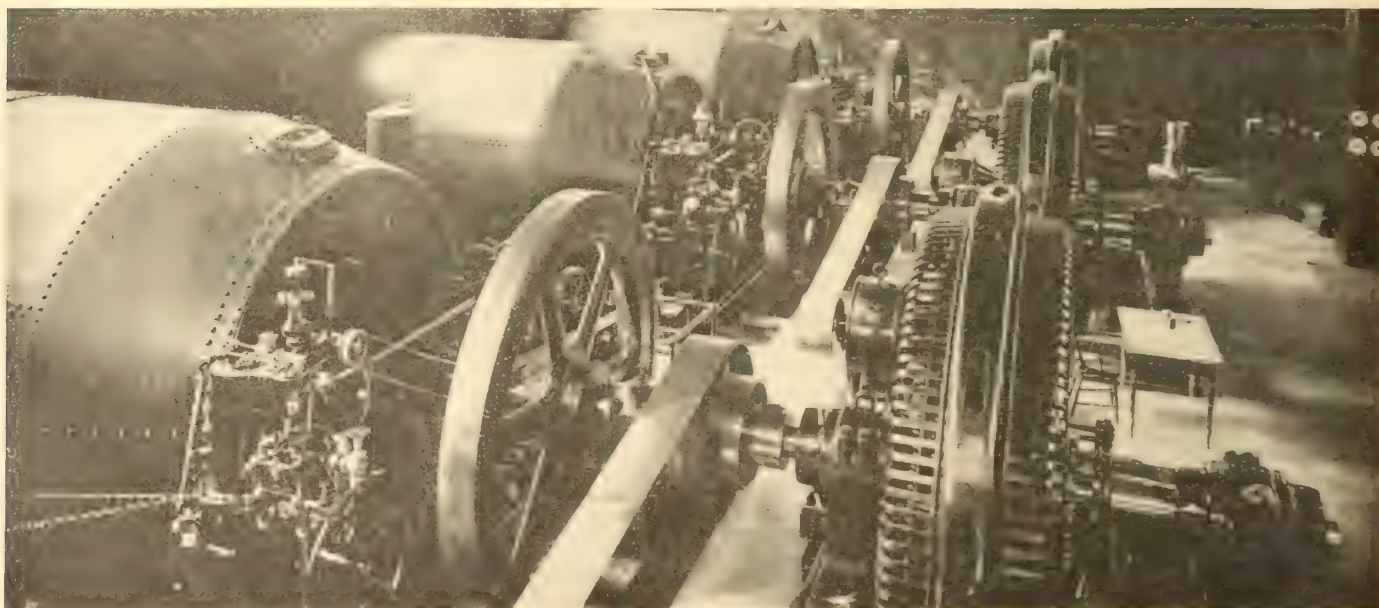


One Corner of Pump House—Espanola

The turbines were supplied by the Holyoke Machine Company of Worcester, Mass., the penstocks by the Jenckes Machine Company of St. Catharines, and the governors are of the Lombard type.

The accompanying cuts show the general plan of the turbines, governors and generators in the generating plant and a corner in the pumping station. The pumps in this station are used for supplying the entire paper plant with water, also for pumping the ground wood pulp from the pulp mill on the lower level to the paper mill above; there is also a booster pump used for fire protection. These are all motor driven as shown.

The total amount of the water development is in the neighborhood of 16,000 h.p., though only about one-third of this amount is used to develop electric power.



Turbines, Governors and Generators—Spanish River Pulp and Paper Company, Espanola, Ont.

K E N O R A

We briefly mentioned in our last issue that the Allis-Chalmers-Bullock, Limited, had obtained the contract for additional equipment for the municipal power plant for the town of Kenora. This includes a hydro-electric unit consisting of a 900 h.p. quadruplex turbine direct connected to a 625 kw. water-wheel type generator. The turbine consists of two twin horizontal runners in open flume each with common centre discharge connected to form a quadruplex unit. This unit will operate satisfactorily under a head varying from 17 to 23 feet, and will operate normally under the following conditions:—effective head 17 feet; maximum output 900 h.p.; normal speed 150 r.p.m.; maximum discharge 580 cubic feet per second.

Two runners, one left and one right hand, will be so arranged that the turbine will rotate clockwise when looking from the driving end. These runners will be made of cast iron with steel plate buckets in one piece. The main turbine shaft will be of forged open hearth steel. The turbine will have an oil pressure governor self contained with single compensation. This governor is guaranteed, when used to regulate the speed of the accompanying turbine, to be dead beat in action, not to hunt, to operate in parallel turbines provided with the other governors, and to give the following speed regulation under fluctuating load:—for sudden changes of load amounting to 900 h.p., the speed will not vary more than 18 per cent.; for 650 h.p. the speed will not vary more than 8 per cent.; and for 220 h.p. the speed will not vary more than $2\frac{1}{2}$ per cent.

The alternator will have a capacity of 625 kw. at 150 r.p.m. 2400 volts, 60 cycles, 3 phase. The laminated field poles will be securely attached to a cast steel spider. The method of ventilation will be such as to secure a rapid movement of air through all parts of the core and windings, thus preventing an excessive local rise of temperature in any portion of the machine. To accomplish this, fans will be provided if necessary to set up a blast of air on each side of the machine. It will have two bearings. The excitation will be supplied from the exciters already in the plant.

The contract includes all the necessary switchboard apparatus for this unit. This will make the fourth water wheel type alternator built for the town of Kenora for its municipal plant by Allis-Chalmers-Bullock, Limited.

S T . T H O M A S

Hydro-electric power was turned on in the city of St. Thomas in April, 1911, and has proven an unqualified success since its inception. The city owns and operates its own gas plant, but despite the fact that gas is sold at 90 cents per thousand, the popularity of electricity as an illuminant is daily increasing. The revenue from the electrical department has been quite satisfactory and fully justifies the capital expenditure of about \$80,000 for the installation of the plant and distribution system. The contract made between the city and the Hydro-electric Commission was for 1,500 h.p. and at the present rate of progress it will only be a short time before the city will be using its full complement.

The streets are served by about 1,000 tungsten lamps on residential streets and 50 flaming arcs on business streets and the service is very satisfactory.

The Monarch Knitting Company have recently installed two 50 h.p. motors, making their total installed capacity about 150 h.p.

The Canadian Iron Corporation Limited are preparing to install not less than 175 h.p. within the next few weeks

and the Michigan Central Railway have been figuring for some time as to the advisability of replacing their present steam plant with hydro-electric power in their car shops. The latter company will use not less than 400 h.p.

A by-law was recently submitted to the ratepayers and passed by a large majority authorizing the expenditure of \$23,500 for increased equipment and \$6,500 for line extensions. It is proposed to extend the line on Ross street from Forest avenue to Hemlock street, a distance of 1560 feet and on William street from Talbot to Central street, a distance of 450 feet. 65-pound rail will be used and 4 ft. $8\frac{1}{2}$ in. gauge. 3 new cars will be purchased and the present equipment will be generally overhauled and renovated.

Mr. E. H. Caughell was recently appointed acting manager of the Light, Heat and Power Department during the absence of Mr. Geo. L. Oill, who is taking a three-months' vacation.

H A M I L T O N

The city of Hamilton, which has long been designated as the electrical centre of Canada, has, during the past year, made some very important and far reaching moves.

The passing, on July 25, 1911, of the by-law to raise \$505,000 by the ratepayers, placed Hamilton among the union of municipalities to use hydro-electric power developed at Niagara Falls and distributed by the Hydro-electric Power Commission of Ontario. This not only meant a competitive power and light supply for the citizens of Hamilton but added another large Canadian city to the already extensive list adopting municipal ownership of public utilities. The municipal system is being installed under the direction of E. I. Sifton, E. E.

The plans of the Hamilton hydro-electric department cover the installation of one main station centrally located and one east end sub-station which is now in operation, having about 1000 h.p. available capacity, and a designed capacity of 4000 h.p.

The proposed street lighting system which is required to be ready for service July 1, 1914, is designed for about 1000 kw. capacity, using 400 ornamental 5-light standards, 300 ornamental 1-light standards and 6500 concrete poles carrying ornamental bracket light, and secondary wires. An underground system has been designed and provided for in the estimates, which will clear about 7 miles of streets of all poles excepting those used for trolley suspension. In this particular, Hamilton will lead all other Canadian municipalities.

Work is progressing very rapidly on the Hydro-electric distribution system, large sections of the city are already provided with service and it is expected by September that Niagara power will be available to all residents or power consumers.

Dominion Power & Transmission Company

The Dominion Power & Transmission Company are building a new transmission line. The line is to be 34 miles in length and constructed on a private right-of-way 33 feet wide owned in fee by the company. Starting from the power-house at Power Glen, which is 3 miles outside of the city of St. Catharines, the line will pass through the counties of Lincoln and Wentworth terminating at the company's switching station which is located just outside the city limits of Hamilton.

The electrical characteristics of the line will be 45,000 volt, 66 cycles, 3 phase. There will be 6 conductors consisting of two 3 phase circuits of the equivalent of $2/0$ copper made up of 6 strands of No. 6 wire wound on a



Flexible Tower

hemp core protected against lightning by a number 1 duplex metal wire consisting of a steel core with 40 per cent. copper coating. No telegraph circuit is being installed. The conductors are to be supported on steel structures consisting of what is known as a flexible "A" frame which are being manufactured by the Archbold-Brady Company of Syracuse, N.Y. They will be approximately 47 feet in height over all, 9 feet wide at the ground line and 33 feet from the ground to the top of the insulator supporting the lowest wire. The accompanying illustration indicates the type of tower. These will be placed approximately 400 feet apart. The insulators are of the usual pin type and are being manufactured by R. Thomas & Sons, East Liverpool, Ohio.

This is the first time towers of this kind have been used in Canada although there have been different lines constructed in the United States and still more in Europe where the idea

for this type of structure originated.

Toronto & Hamilton Electric Company

The manufacturing plant of the Toronto and Hamilton Electric Company comprises some 8,000 feet of floor space. The shops are equipped with the latest types of machines and apparatus for construction of the dynamos, motors and other electrical equipment manufactured by this firm. At the present time the company has several months of work ahead of them. They have also recently purchased a lot on which they will probably build as a result of their present quarters becoming very much cramped with growth of business.

Other Important Industries

The establishment in Hamilton of the Standard Underground Cable Company of Canada, Limited, and the Boston Insulated Wire & Cable Company, places Hamilton, with her already large electrical industries, in the first place as an electrical manufacturing centre. Readers of the Electrical News will do well to stop off and see for themselves all Hamilton's hospitality can show them.

MONTREAL

Some time ago we announced that the Cedars Rapids Manufacturing & Power Company had been acquired by the Montreal Light, Heat & Power Company, the Shawinigan Water & Power Company and other allied interests. Recently the officers of the Cedars Rapids Manufacturing & Power Company have been changed somewhat, and at the present time the engineering officers are: R. M. Wilson, electrical engineer; Julian C. Smith, hydraulic engineer; Henry Holgate, consulting engineer; C. S. Bagg, purchasing agent. Plans have been prepared for a large development at Cedars Rapids. The plant will ultimately be one of the largest in Canada, totalling about 160,000 horse power.

Specifications have been sent out to all the leading contracting firms in Canada and the United States and tenders have been received. The contract will be awarded within the next few days. Work has already commenced at Cedars pending the completion of the contract, and it is anticipated that the first units will be in operation in about two years.

Owing to the close association with the Montreal Light, Heat & Power Company and the Shawinigan Water & Power Company, the future development of the company is assured, and the plant will undoubtedly be rapidly developed.

To Enlarge Open Aqueduct

The city of Montreal has obtained powers from the Quebec Legislature for carrying out a big scheme for enlarging the open aqueduct and generating electric power for pumping and lighting purposes in connection with supplying the city with additional water. The plans now being prepared will provide for a development of 10,000 horse power, of which 6,000 will be utilized for pumping one hundred million gallons daily for the water supply and the remaining 4,000 for other city purposes. This latter will be used for lighting parks and streets, the idea being to ultimately develop sufficient power to light the entire city. At present the city is supplied by the Montreal Light, Heat & Power and other companies, but the contracts have only a few years to run. The original purpose was to widen the aqueduct for power for the water supply only, (this work is being carried out by Haney, Quinlan & Robertson), and the decision to develop power for light will necessitate still further deepening and widening. The power so obtained will be utilized for running the turbines, which will operate the pumps, etc., thus doing away with steam except as a reserve. The water for the aqueduct will be obtained from the St. Lawrence just above the Lachine Rapids, and it is estimated a 24-foot head of water will be secured. The aqueduct will run almost the entire length of one portion of the Island of Montreal. The present pumping station will be remodelled, in order to fit in with the new plans. The total cost of the scheme will be five million dollars, of which \$2,000,000 will be spent on the public lighting system.

The Montreal Electrical Society

The Montreal Electrical Society, an organization appealing to the younger members of the electrical industry, has now been formed, and makes a very promising start. The main object is the dissemination of electrical knowledge, by means of meetings, visits to plants and social intercourse. The provisional officers elected are Mr. P. T. Davies, president; Mr. T. N. Nicholson, vice-president; Mr. J. C. Bray, secretary; Mr. W. H. Tees, treasurer, and it is also intended to appoint a board representing the various sections of the electrical interest.

At a meeting held in Fraser's Hall on May 21st there were over one hundred present, and from the expressions of opinion it was evident that there is need of such a society. Mr. Davies, who presided, declared that a society of this kind would enable workers in the electrical industry to become better acquainted, and to work together instead of independently and often in contrary directions. While there were other electrical societies in existence, none catered to all electrical men in good standing, whether telephone, telegraph, street railway, contracting or other branches. In Montreal, with the largest electrical companies, the largest telephone company, the largest number of factories using electrical power, the headquarters of the largest railways, both electrical and steam, there was not even a branch of the Canadian Electrical Association, which had its headquarters in Toronto. He hoped their society would act as feeders for the older and more traditional societies. Mr. Davies then referred to the origin of the society, and stated that four visits to places of interest had been arranged

for during the summer, and that during the winter various papers on electrical work would be read at meetings of the society.

Mr. J. M. Robertson; Mr. Camp, assistant manager of the telegraph department of the C. P. R.; Mr. J. Bennett, chief inspector, Canadian Fire Underwriters' Association; Mr. Sayer, Mr. Nicholson and others, spoke. One of the chief points referred to was the opening for such a society, covering a field entirely untouched, and enabling men who were not eligible to become members of the Canadian Society of Civil Engineers to meet together for the purpose of gaining knowledge and social intercourse.

During the evening letters wishing the organization success were read from Prof. Herdt of McGill; Mr. Wilson of the Montreal Light, Heat & Power Company; Mr. D. E. Blair, of the Montreal Tramways Company, and Mr. G. H. Winter, of the Bell Telephone Company.

Montreal L. H. & P. Annual Report

Increases all round are shown in the annual report of the Montreal Light, Heat & Power Company for the year ended April 30th. This will be seen from the following statement:—

	1912	1911	Inc.
Gross	\$4,969,254	\$4,404,126	\$565,128
Expenses... ..	2,125,238	1,827,786	297,452
Net... ..	2,844,015	2,576,339	267,676
Charges... ..	485,746	472,051	13,695
Surplus	2,358,268	2,104,287	253,981

After payment of dividends, a sum of \$998,268.77 is left, and of this \$490,000 is appropriated to depreciation and renewal reserve account (in addition to \$75,000 for the same purpose during the year) and \$10,000 to the officers and employers' pension fund, leaving \$498,268 to be transferred to general surplus. During the year an expenditure of \$1,001,984 was made on capital account. In the report the purchase, with allied interests, of a control in the Cedar Rapids Company, which will develop 150,000 horse power, is mentioned, in reference to provision being made for future demands on the electric supply of the company.

Onus Rests With Contractor

Judge Beaudrin, of Montreal, has given judgment in a claim for \$1864 brought by the Hill Electric Switch Company against the Ecole Technique de Montreal. The claim was for balance on the contract price of installation work, and also for extras. It was stated for the plaintiffs that the specifications conflicted with the rules of the Canadian Fire Underwriters' Association, and that they notified Mr. Archibald, the architect, and the defendants, but no notice was taken; the architect, however, later gave a verbal permission to go on with the extra work involved. Mr. Archibald denied this, and said the alleged discrepancies were discovered by plaintiffs after the expiration of the time when the whole work was to be completed. The Judge in dismissing the claim, pointed out that a contractor should carefully examine all plans and specifications connected with works on which he is tendering and if he finds therein certain dispositions contrary to the rules of the Underwriters' Association, he should make this known before accepting the contract. Otherwise, he will be unable to make an overcharge for extra work which he claims to have done in carrying out the work in accordance with what he considered to be the spirit of the Underwriters' regulations. While dismissing the plaintiffs' claim, their recourse for the recovery of \$628 was reserved.

Electrical Association of Province of Quebec

The Electrical Association of the Province of Quebec have under consideration the question of the compulsory

licensing of electrical contractors and wiremen. The subject was referred to a committee which reported in favor of licensing, and the report was discussed at a special meeting, at which the various suggestions were discussed. The subject came up again at the ordinary meeting held on May 9th, when Mr. Clarence Thomson presided. As the result of the discussion, it was decided to refer the report back to the committee, and to obtain the opinion of all electrical contractors in the city as to the advisability of approaching the proper authorities with a view to making licensing compulsory. The meeting was favorable to the idea, but felt that all contractors should be consulted. The committee, which considered the subject, obtained from several U. S. cities and from Halifax, N.S., copies of by-laws enforcing compulsory licensing and inspection. Mr. Parsons was elected a member of the executive.

Sub-Contractor Not Responsible

Judgment has been given by the Court of Appeal, Montreal, in a case which has been before the Courts for 12 years and which involves the sum of \$1,340,000. It relates to the dam erected across the Richelieu river at the head of the Chambly Electric Manufacturing Company's generating plant, which collapsed piecemeal owing to the pressure of the water being too great. The contract was given to the Stilwell, Bierce and Smith Baile Company of Dayton, Ohio, who sublet the concrete work to Mr. Peter Lyall. By an arrangement between the parties, Mr. Lyall was sued for damages on the understanding that any sum recovered would be turned over to the Montreal Light, Heat & Power Company, which absorbed the Chambly undertaking. The question at issue was as to the liability of a sub-contractor guaranteeing work done. The lower Court held that as Mr. Lyall had done the work according to plans, the contractors were alone responsible. The Court of Appeal has upheld the decision of the lower Court on the main points.

Was Secretary of Northern Electric

After an illness of about a month, Mr. John Black Britton, secretary and assistant treasurer of the Northern Electric and Manufacturing Company, Limited, Montreal, died on May 20th of rheumatic fever. Mr. Britton was born in Hamilton and prior to joining the Northern Electric, two years ago, was for several years with the Bell Telephone Company. Mr. W. H. Black, secretary of the Bell Company, is his uncle.

Will Reduce Rates Once More

Beginning July 1st, the Montreal Light, Heat & Power Company will again reduce the price of their electric light and gas rates, the fifth reduction in four years. The new rate for electric lighting service will be 10c. per kilowatt hour, less 30 per cent., a flat rate of 7c. per kilowatt hour for electric lighting—a reduction of $\frac{1}{2}$ c. on the present rate. Concerning the attitude of the company towards the underground conduit installation, Mr. J. S. Norris, general manager, explains that, in the past, reductions in rates have been, in large measure, permitted by the relatively low investment cost for overhead service, as contrasted with the underground service, and while the company have every sympathy with the removal of wires and poles from the commercial and congested districts, as contemplated by the city of Montreal, the extra capital entailed must inevitably increase the cost, and it is not unlikely, therefore, upon the inauguration of the civic underground system, that some adjustment as regards underground service will be warranted.

Montreal Conduits Commission

Mr. Beaudry Leman has resigned as representative of the council from the commission, owing to pressing private business. In his letter to the Board of Control he com-

plained of unjust criticism with regard to the progress of the work.

The controllers have recommended that the commissioners be paid \$2000 a year in addition to the present sum of \$10 per meeting.

Permission has been accorded to the Bell Telephone Company to construct underground conduits in 26 streets, with the proviso that the conditions must be agreeable to the city. The company will have to provide the city with one free duct in each conduit for the use of the firm alarm and police patrol wires. As much excavating of streets will be required, the controllers also stipulate that all streets must be restored to their former condition, and that before the company begins work they shall deposit a sum of money equal to the approximate cost of the repairs.

Costs Montreal Only \$200,000

According to a report issued by Mr. Parent, superintendent of the Montreal civic lighting department, the electric lighting services for the city this year will cost about \$200,000. The city uses four kinds of lamps; the first includes all 6 and 5.10 ampere arc lamps which are used on the principal commercial and residential thoroughfares. Each lamp, of which there are 500, costs, to light it, \$72.70 annually. The second class covers arc lamps of the four ampere magnetite type. These are furnished on all streets and thoroughfares outside of those dealt with in the first class. There are 2,300 of the lamps, the lighting of each one costing the city \$63.15 a year. Nine hundred 80 and 40 candle power tungsten lamps are lighted at an annual cost of \$23 per lamp for the larger, and \$16 per lamp for the smaller sizes. Contracts for all the civic lighting are divided between the Montreal Light, Heat & Power, the Saraguay Electric, and the St. Paul Electric Light Companies.

Mr. Lancaster in Charge

Mr. W. C. Lancaster, E.E., M.E., of New York, has been appointed electrical and mechanical engineer in charge of the construction plant and of the permanent electrification work of the Canadian Northern Railway tunnel through Mount Royal, Montreal. Mr. Lancaster, who has now joined the staff, will design the plant and later superintend the electrification of the railway. It is proposed to utilize electricity as far as possible in the construction of the tunnel. Mr. Lancaster has had a wide experience in tunnel building and in the electrification of various United States lines. He was electrical mechanical superintendent in charge of the electrification of the cross town lines of the Pennsylvania R. R. in New York, was one of the engineers engaged in the construction of the New York aqueduct, electrical mechanical superintendent of the Cuban Engineering Company in Havana and made the first tests of electric locomotives on the New York Central lines.

Power Companies Cannot Obstruct Business

The Court of Appeal, Montreal, has dismissed an appeal in the case of Julien vs. the Canadian Light, & Power Company, which involved the jurisdiction of the Public Utilities Commission. The Court ruled that power companies, etc., must not interfere with the right of travel. Julien claimed that the company, constructing a bridge on the Beauharnois canal, raised the public highway leading to the bridge and prevented free access to his store. The Revised Statutes clearly state that public utilities companies must not obstruct the entrance to any door or gateway, or free access to any building. The Public Utilities Commission supported Julien's claim, and the Court of Appeal confirms the judgment.

Will Make Better Progress

The Canadian Light and Power Company and the Montreal Tramways Company have now provided the city of

Montreal with their requirements in the way of conduit accommodation along St. Catherine street. This will enable the Conduits Commission to make better progress with the work; but even now some of the aldermen are dissatisfied at the rate at which the preliminary work is being done, and Mr. Alderman Lapointe has pointed out that after five years some of the companies can claim compensation. Three years have expired, and if the conduits are not under way at the end of the five years, the city will have to pay full compensation for the companies' poles and wires.

Montreal Tramways Co.

The statement of the Montreal Tramways Company for March completes the earnings for the first half of the fiscal year. The total was \$2,533,428, an increase of \$330,514, or 15 per cent. The net earnings for the same period were \$963,861, an increase of \$131,419, or 15.79 per cent. The surplus after meeting all fixed charges was \$702,559, representing an increase of 16.47 per cent. The March statement shows that net earnings were \$156,695, representing a gain of 13.95 as compared with a gain of 15.79 for the whole six months, while the surplus for the month was \$101,175, an increase of 11.08 per cent.

Mr. Howard Murray, the president of the Canadian Carbide Co., Ltd., and treasurer of the Shawinigan Water and Power Company, has been nominated for the second office in the Montreal branch of the Manufacturers' Association.

Room for New Industry

Elsewhere in the paper is an advertisement in which a firm of panel board manufacturers state that they have decided to dispose of their panel board business. This party is engaged in the electrical contracting business and have installed some very large equipments, but found that the two branches did not work well. This is not so very surprising, since they would, to a large extent, have to depend upon the very people with whom they compete for contracts on buildings, to buy their product, and as a rule contractors do not like to do this.

There is no doubt that there should be a good field for an industry of this kind here in Canada, as there are very few panel boards, metering boards or cut-out cabinets manufactured here, the contractors finding it necessary and cheaper to import the same from the United States, paying a duty of 27½ per cent. to which must be added the freight and charges for clearance through customs. This protection is so great, that it is surprising that the industry is not taken up to a larger extent. While new industries are springing up daily, it would seem that this important field has been neglected.

Resuscitation from Electric Shock

The Commission on Resuscitation from Electric Shocks, representing the American Medical Association, the National Electric Light Association and the American Institute of Electrical Engineers, has issued a set of rules for resuscitation from electric shock, in the form of a small booklet. This booklet will be bound in flexible cloth covers and should be in the hands of every man who is in any way connected with electrical work. It is advised that superintendents and foremen and others having charge of men doing electrical work should not only see that this booklet is studied but should give practical instruction and demonstrations of the carrying out of these rules. The instructions are also printed in poster form suitable for pasting up in prominent places in power houses or other buildings.

Saraguay Electric & Water Co.

At the annual meeting of the Saraguay Electric & Water Company, held in Montreal, the following officers were elected: Mr. E. A. Robert, president; Mr. G. Deserres, vice-president; Mr. E. Champagne, managing director; Mr. E. Hurtubise, secretary; executive committee, Mr. E. A. Robert, president; Mr. Deserres, Mr. E. Champagne and Mr. K. B. Thornton. The members of the board of directors are: Messrs. E. A. Robert, G. Deserres, T. Bastien, E. Champagne, Hon. Hector Champagne, Messrs. F. J. Shaw, R. N. Smythe, K. B. Thornton and J. M. McIntyre.

A Belt Line Tramway

A special committee of Montreal aldermen have reported in favor of a belt tramway line connecting the four railway stations, in order to facilitate access to the various depots. The committee expressed the opinion that at present people are obliged to take too many transfers when desiring to get to the stations.

G R A N B Y

The town of Granby, Quebec, is following a new plan of lighting its streets. They have taken down the old arc lamps and have installed a number of what are known as Warner Tungsten series street lamps, each giving a light equivalent of 350 c.p. Forty-three of these lamps have been installed similar to that shown in the accompanying cut.



Type of Lamp Used in Granby

This lamp derives its name from the fact that it resembles, somewhat, an arc lamp in appearance, though it uses a large tungsten incandescent. The type used in Granby is for series operation, all the forty-three lamps being run in one continuous circuit. In the upper part of the fixture, as shown in the cut, an automatic circuit-closing device is installed which closes the circuit if the lamp burns out, and also switches into the circuit four non-inductive resistance units which keep the line conditions balanced. Suitable provisions are made for adjusting these resistance units to absorb the same voltage as the bulb in

use. The use of this special fixture enables one to discard the usual regulator and it is claimed that a series of lamps used with this fixture will give a unity power factor and operate at an efficiency of 100 per cent. This is in comparison with a usual power factor of, say, 70 per cent. where a current regulator is required.

In making up this series of lamps it was of course necessary to have the combined voltage of all the lamps in the series equal to the impressed line voltage. In Granby just sufficient lamps were installed to fulfil the required conditions. The installation of any type of transformer was therefore avoided.

The lamps used in Granby are 350 c.p., carrying 6.6 amperes. The price per lamp is in the neighborhood of \$20, the total installation not costing the town more than \$1,000. Tungsten lamps operating under these conditions are guaranteed for 1,500 hours' life, which would be about one year's service, but there are cases on record where they have burned over 3,000 hours and are still in service. The town electrician, Mr. F. B. Farnsworth, planned the Granby installation and had charge of the construction work throughout. The equipment was supplied by the Warner Arc Lamp Company, of Wilton Junction, Iowa.

T H R E E R I V E R S

Electrical conditions in Three Rivers are reported as never having been in a more flourishing condition.

Power there is furnished exclusively by the North Shore Power Co., which is a subsidiary of the Shawinigan Water and Power Co. The North Shore Co. has a plant on the Batiscan River 22 miles from Three Rivers sending power to Three Rivers by two lines, one at 11,000 volts and the other at 15,000, three phase, 60 cycle. In addition to this there are two lines from Shawinigan Falls bringing in power at 50,000 volts, three phase, 30 cycles. All lines terminate in one central station at Three Rivers. Transformer capacity is at present, five 200 kw., 60 cycle transformers, three 300 kw. single phase, and one 1000 kw. three phase, 50,000/2400 volt, 30 cycle, transformers. They are at present installing another 1000 kw. and a 2000 kw., 50,000/2400 volt, three phase, 30 cycle, transformer to take care of two factories now building. In addition to load supplied from these transformers, the company have one customer taking power at 50,000 volts, the line being controlled from the above central station.

Practically all power used in Three Rivers is supplied through the North Shore Co., the only steam power being that used by one saw mill, one planing mill and one chair factory. There is a total of 1200 h.p. in 60 cycle motors, and 10,900 horse power in 30 cycle motors, 8000 h.p. of this being taken directly from the one customer on the 50,000 volt line. There is also at present building a paper mill which will use 2000 h.p. and a cotton mill which will use 1500 h.p.

The North Shore Co. also has a contract with the city for pumping the water. This is all done by centrifugal pumps driven by electric motors, and the conditions and installation are so satisfactory that the Canadian Fire Underwriters Association do not require them to keep up steam continually. The steam pumps are however operated at intervals to satisfy the city inspector that the plant is in good condition.

The city of Three Rivers was swept by fire in 1908, and the entire business portion of the city was burned. This has now been rebuilt in much better form, and the electric wiring in the new buildings is well done. In the old portion of the city however the wiring is in very bad shape generally. It is expected that the underwriters will send

their inspectors over this ground very soon and that this wiring will be condemned and done over properly.

The city has just contracted for a new fire alarm telegraph system which is to be installed immediately by the Northern Electric and Manufacturing Company.

A possibility for the near future is an electric street railway. This has been incorporated and has its charter, but one condition is that the city shall own at least 75 per cent. of the stock, so it will be practically a municipal enterprise. Little progress is being made therefore as the feeling in favor of the chance of success of municipally operated public utilities is reported not strong in Three Rivers.

The North Shore Co. operates under a franchise given in 1896, and is obliged to give lighting at flat rates when demanded. These rates are fixed by the franchise and are so low that the biggest part of the lighting is on the flat rate. It is said to be a surprise to visitors to see how many lamps are left burning in broad day light, when absolutely not needed. There are about 10,000 16 c.p. equivalents connected on flat rate, and about 9000 on meter rate. Mr. Ralph B. McDunnough is manager for the North Shore Company.

Q U E B E C

An improved service of electric lighting through the principal thoroughfares and terraces of the city of Quebec is to be installed by the council at a cost of \$35,000. The plans have been prepared by Mr. W. D. Baillarge, the city engineer, who has just returned from Germany, where he had an opportunity of studying the improved system of street lighting in operation in Berlin and Hamburg. In these cities the system has given the most satisfactory results. It is installed in the principal commercial streets and has been the means of greatly stimulating trade on these thoroughfares. The lights are to be in clusters, supported by ornamental posts of iron or steel, and the wires are to be placed underground. The work will be carried on during the summer, and it is expected that the system will be in full operation by November next. Dufferin Terrace, the favorite promenade of the citizens, will be illuminated, as well as the following streets:—Mountain Hill and the principal parts of Dalhousie, St. Nicholas, Palace, Gignac, Crown, St. Valier, d'Aiguillon, St. Joseph, St. Paul, St. John, Fabrique, Baude, Fort and St. Louis streets. Place d'Armes and Grande Allee and Abraham Hill.

On May 11th, the Canadian Fire Underwriters' Association, through Mr. J. Bennett, chief electrical inspector, complained to the Quebec Public Utilities Commission of electrical conditions, particularly as to overhead wires in Quebec. The Commissioners on May 28th gave a formal decision, finding the complaint justified, and making regulations forbidding the placing of high tension wires within dangerous distances of buildings or of other wires, for the proper stringing of such wires, and for the financial responsibility in cases where poles or wires are to be removed or changed.

EDMUNDSTON

By J. A. Roy, Superintending Engineer

The town of Edmundston, N. B., inaugurated, in December, 1911, its hydro-electric plant which supplies the energy for the waterworks and electric light systems. The power is generated on the Green river, at a place called the Second Falls, distant ten miles from the town. There, a dam 400 feet long, 24 feet high and 35 feet wide at the base, was built of round birch and spruce timber. This construc-

tion, undertaken by the town on the day work system, under the supervision of the engineer, was carried out during the winter of 1910-11, with a crew of 75 to 100 men.

The round timber secured from the surrounding woods, at distances ranging from one mile to three miles, was brought to the site, divested of bark and laid in place, the first tier being well anchored to the rock bottom of the river. By means of very primitive cofferdams, the course of the water was diverted and confined to the natural channel of the river about 35 feet in width. This permitted the construction of the cribwork from both sides of the river at the same time. These two portions were completely finished with their stone filling and double row of three-inch birch planking, before any attempt was made to close the channel. Here some difficulty was encountered on account of the swiftness of the current. However, it was overcome and the base of the dam was completed only a few days before the spring high water and the run of the logs from lumber drives higher up the river. The work on the piers and power house was carried on throughout the summer and fall of 1911.

As may be seen from the photograph, the dam is of the sluice type; there are 13 sluices 16 feet wide, and as many piers 8 feet wide and 22½ feet long at the top. Although the dam was designed to be 18 feet high above the sill, it was actually built with piers only 13 feet high as being sufficient to secure the required 20-ft. head. Eventually the piers will be raised to 18 feet as the banks of the river are high enough to offer protection against flooding of the adjoining plateau. With the actual height of the dam, the pool created extends two miles back, thus securing a good storage of water for the production of the necessary power, during the minimum stream flow in the dry season.

A feature to be noted in connection with the Green river, is that the least rain increases to a large extent the amount of water in it. This is due to the large area of



Edmundston, N. B.—Downstream Side of Dam.

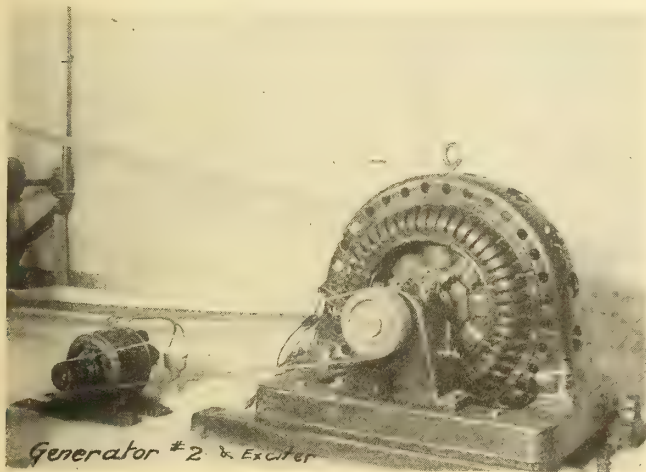
mountainous country draining towards the river and thus constituting a source of supply.

Slow progress was made in the excavation for the power house and tail race, on account of the difficulty of getting rid of the water which seemed to find its way into the cracks of the rock upstream and came oozing through the stone bed at the point of excavation. Pumps had to be kept running night and day and it was only after much labor and a great expenditure of money, that the foundation bed was reached. Foundation walls were easily built and the reinforced concrete power house was soon ready to receive the machinery, waterwheels and generators.

The waterwheels consist of two complete turbine units

for belt connection to generators, each unit capable of developing 275 h.p. at 250 r.p.m. under a working head of 20 feet. Each unit is composed of one pair of 25 inch special gate turbines, right and left hand, set horizontally in a heavy cast iron draft chest, with a draft tube 10 feet long and placed in a separate flume built of reinforced concrete. The necessary gate mechanism for each unit is directly connected to a Woodward compensating vertical-type governor adjusted to operate the two complete units at uniform speed, under different loads. These turbines, supplied and installed by the Jenckes Machine Company, Limited, were tested and operated under full load to the complete satisfaction of the engineer and corporation of Edmundston.

The electrical equipment of the generating station con-



Generator with Belt-Driven Exciter. Edmundston

sists of two 115 kw. 2,300 volt, three-phase, 60 cycle, 900 r.p.m., belt-driven alternators, with exciters belt-driven from front ends of generator shafts; three 75 kw. single-phase step up transformers, 2,300 to 15,000 volts; two switchboard panels, one for each machine, with meters, switches, synchroscope, frequency meter, etc. Three multi-gap lightning arresters are also installed.

It will be noted that the capacity of the waterwheels is almost double that of the generators. This was done intentionally, as the present needs of the town of Edmundston do not involve the necessity of larger dynamos. Provision was made, however, in the capacity of the turbines, for future growth and development of the town, ample room being also provided in the power house, so that additional or larger generators could be installed without going to any other expense than the cost of purchase and installation of the new machines with accessories.

The transmission line, 10 $\frac{1}{3}$ miles long, is a single circuit, three-phase line, of No. 4 hard drawn bare copper wire carrying 15,000 volts. The wires form an equilateral triangle, being spaced 34 inches apart; two wires are carried on a cross arm, the third is placed on a ridge iron on top of the pole. Poles are white cedar, 7 and 8 inches diameter at the top, 30 feet long and spaced 120 feet apart. There are three transposition points on the line dividing it into four approximately equal lengths. At each transposition point, each wire is displaced 120 degrees.

A telephone line, connecting the generating station with the sub-station is attached to the poles by means of side blocks six feet below the cross-arm and is transposed every five poles. The transposition takes place between two poles and to prevent the wires touching where they cross, one side block on each pole, but on opposite sides, is dropped 12 inches, the two wires forming a spiral.

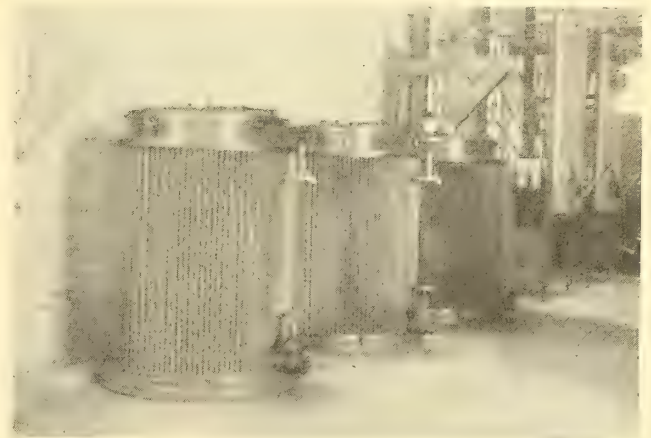
The electrical equipment of the sub-station at Edmund-

ston consists of three 75 kw. step-down transformers similar to those in the generating station; three multi-gap lightning arresters; one high tension and one low tension switchboard with accessories; one 15 kw. transformer for series street lamps; one reactance regulator for same and one lighting switchboard with accessories.

The distribution system in the town is about five miles long. The streets are lighted by 155 mazda tungsten lamps, 75 watts, 6.6 amperes, spaced 120 feet apart on principal streets and 240 feet apart on other streets.

The complete electrical apparatus was supplied and installed by the Allis-Chalmers-Bullock Limited, of Montreal, and proved, from the test, a first-class installation, and since has given every possible satisfaction.

The service required from the pumping installation is to pump 700 U. S. gallons of water per minute against a domestic pressure of 90 pounds and a fire pressure of 130 pounds with suction lift of 10 to 20 feet with steam pressure of 120 pounds at the pump. For this service, there was installed one 16-in. x 10 $\frac{1}{4}$ -in. x 10-in. Worthington duplex regular pattern plunger and ring pump and one 60 h.p. return tubular boiler with feed pump and multi-current feed water heater. The boiler is connected to a self-supporting steel plate smokestack 33 inches diameter and 60 feet high. The sub-station is also equipped with a 6-inch three-stage Worthington turbine pump, directly connected on a common bed plate to a 125 h.p. A.-C.-B. motor. The intention is to operate this pump from the hydro-electric generating plant and to use the steam pump simply as a stand by, in case of accident to the electric pump. The pumping mach-



Transformers and Switchboards. Edmundston

inery is to deliver water into a stand pipe situated on the summit of a hill, 173 feet above the pumps. This stand pipe 35 feet diameter and 50 feet high, has a capacity of 344,000 U. S. gallons. When completely full, the pumps being at rest, the water gauge registers 90 pounds pressure at the pumps. The hydrant static pressure has been recorded to be 65 pounds in the higher part of the town and 95 pounds in the lower part. The stand pipe was supplied and installed by the Jenckes Machine Company, Limited.

The requirements of the town are such that the pumping machinery is in operation only one hour and a half each day, thus not interfering with the lighting of the town at night. The peculiar feature of this pumping plant is that the water is taken from two driven wells having at their lower extremities 8-in. Cook patent brass strainer heads 10 feet long. These strainer heads, driven into a gravel and sand formation to a depth of 50 feet below the ground level, are situated 500 feet from the bank of the Madawaska river and draw the water through the sand and gravel for this distance of 500 feet, thus ensuring a naturally filtered

water of the greatest purity. The town thus has all the advantages of a complete up-to-date modern filter plant without the expense of installation and maintenance of such a plant. Mr. V. H. Dupont, of Montreal, consulting engineer for the town of Edmundston, is to be highly congratulated upon having taken advantage of the natural opportunities offered.

The level of the water in the gravel bed follows the level



Edmundston Receiving Sub-Station.

of the river up and down, and it has been found that when pumping 700 gallons of water per minute into the stand pipe, the level of the water over the strainer heads does not vary at all, so that there is ample room for future increase of the water supply, without going to any other expense than installing additional strainer heads.

The pumping plant was installed by the John McDougall Caledonian Iron Works Company, Limited, of Montreal, and has given the greatest satisfaction both to the residents of the town and to Mr. V. H. Dupont, under whose supervision the plans and the work were executed.

Mr. L. A. Dugal, mayor of Edmundston, under whose administration the construction of this Hydro-electric plant



Stand-Pipe, 35 Ft. Diam. 50 Ft. High.

has been conceived and carried out, is to be congratulated on the great work he has done towards the development and prosperity of his town.

The Maritime Provinces always make a special effort to send delegates to the Canadian Electrical Association Convention. It is anticipated this year will be no exception.

HALIFAX

The Halifax Electric Tramway Co. has recently closed a contract with the Canadian General Electric Co. for a 2000 kw. steam turbine driven unit for the Halifax power house. The contract calls for delivery in time to take care of this year's peak load. This unit, the first of the type for the Tramway Co., will practically double the capacity of the power house.

It is interesting to note the effect the tungsten lamp has had on the output of this company in the last few years. Four year ago, when this type of lamp was little known and appreciated by the general consumer, the Tram Co. was practically carrying a capacity load in December, the time of greatest demand. During the following year, it was found that notwithstanding the usual increase in business, the peak load had not increased, but rather the reverse was experienced; and for the three or four succeeding years, the more general adoption of the high efficiency lamp enabled the company to carry the load without increased expenditure for additional plant. The balancing effect however, reached its limit last year, when it became evident that extensions in the power house would be required to cope with the business of the coming year.

The double tracking of the loop line, that part of the street railway system serving the north and western part of the city, is now being carried vigorously forward. This, when completed, will add something over 3 miles of line to the system, and will mark a decided improvement in the service for the district covered, and should react favorably on the receipts of the company. Plans are in preparation to extend this line to the head of the North West Arm next year.

The Western Union Telegraph Co. have recently moved to their newly fitted up, and more commodious quarters at 140 Hollis street. The new office has been equipped with a storage battery outfit consisting of 160 cells of D5, 238 cells of P.T., and 160 cells of C.T. Chloride type, the whole being charged from the Tram Company's mains through a mercury arc rectifier.

AMHERST

Unique among the central stations on this continent is that of the Maritime Coal, Railway & Power Company, Limited, situated at their Chignecto colliery, about eight miles from Amherst, N. S., for probably nowhere else in America is the latent energy of the coal sent direct from the mine and placed at the disposal of the consumer in such flexible form as electricity.

Another interesting feature about this plant is, that the coal used is the slack from the screens. This slack is just so much good coal in an unmarketable condition; a by-product of screening and handling. At most mines this is not only a loss, but a great nuisance. Different methods have been resorted to to get some return from it, with varying success. This company decided to turn it into electrical energy and a small plant was erected about four years ago as an experiment. Later the capacity of the plant was doubled and to-day it is taxed to its utmost. The capacity is to be again doubled this summer, probably by the installation of two turbine sets.

The power house, which is just in the rear of the mine bankhead, is a brick and concrete building 100 ft. long by 75 ft. wide and 30 ft. high. It is divided lengthwise, the boiler room taking about two-thirds of it. The eight 150 h.p. Robb return tubular boilers are equipped with the Jones automatic underfeed stokers, and a Cochrane feed-

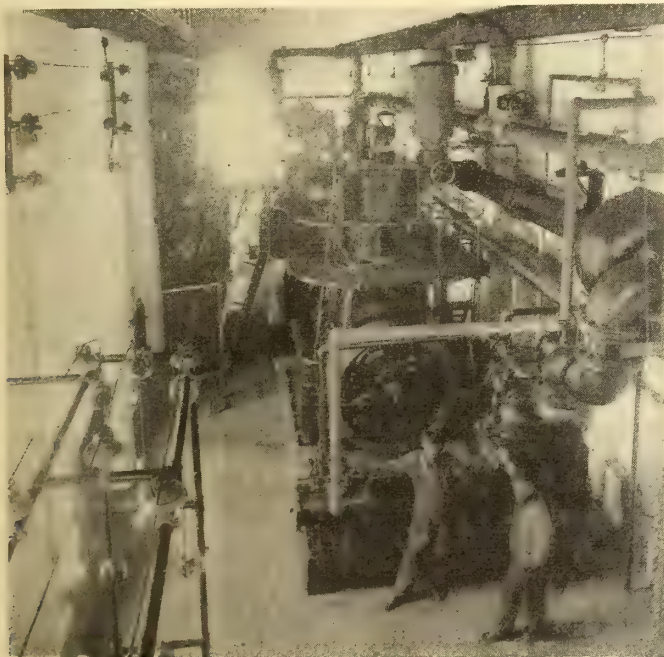
water heater and purifier, which heats the water to about 200 deg. or 212 deg. F. A forced draught is supplied by a motor driven fan, and the coal is brought direct from the screens to the feed bins by a Jeffery cable conveyor. The present installation of the power house proper, consists of



Boiler Room Showing Automatic Feeders.

a 750 h.p. Robb-Armstrong 16-in. vertical, compound, condensing engine directly connected to a 500 kw., 11,000 volt, 3-phase, 60 cycle Can. Gen. Electric generator, and its exciter; and a duplicate engine directly connected to a 500 kw., 11,000 volts, 3-phase, 60 cycle, Westinghouse generator and exciter. The switchboards, which at present occupy a position at one side and midway between the two generating sets, will have to be moved and the building enlarged for the new installation.

The transmission line is about twenty-five miles long

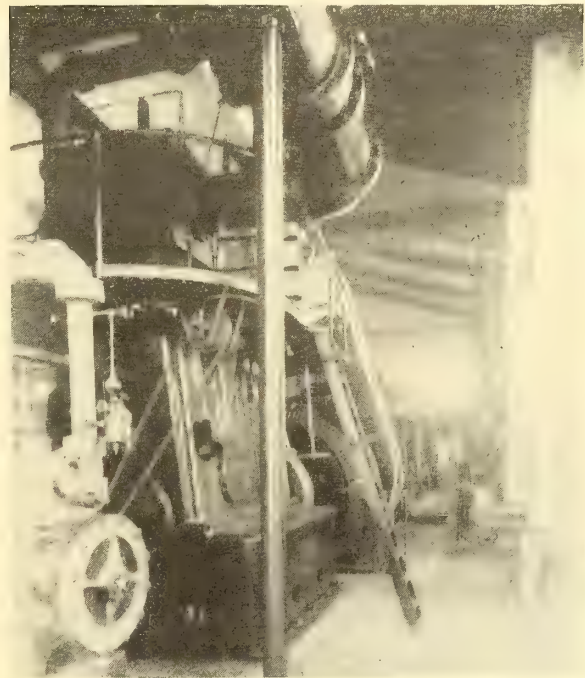


View of Engine Room—Chignecto Colliery Plant.

altogether, and the power house is at a point eight miles from one end. It consists of three No. 6 hard drawn bare copper wires carried on cedar poles about fifty-two to the mile. Three petticoat high tension insulators, both glass

and porcelain, are used. The height of the poles varies with the profile of the ground but averages about thirty feet. The line crosses private land and follows the public highway for a short distance, but for the most part follows the company's railway. At railway and public highway crossings two and three extra high poles are used on each side with double cross arms and insulated wire crossings.

Power is transmitted to Amherst, Maccan, Nappan, River Hebert and Joggins Mines. At each of these places there is a small step down station. The voltage is stepped down to 110 for lighting, but for power it is used at different voltages to suit requirements. In Amherst the demand greatly exceeds the supply. This is a growing, wide-awake town of about 9,000, and has now between fifteen and twenty manufacturies of considerable size with prospects of more in the near future. Besides the street and general lighting, power is furnished to a large number of the industrial concerns. Among the larger consumers are the McLean Milling Company, the Canadian Car & Foundry



View of Engine Room—Chignecto Colliery Plant.

Company, the Robb Engineering Company, and the Hewson Pure Wool Goods Company. Everything from ice cream to Pullman cars is manufactured with power from the colliery.

At Joggins Mines, where another of the company's collieries is situated, the energy is supplied for general lighting, and at the mine is used for lighting and power, both overground and underground. The current is transmitted from the transforming station to the 2800 level of the mine at 2200 volts, where it is stepped down to 220 volts for distribution in the pit. The power is used underground for pumping, haulage and coal cutting. Overground it is used for pumping, running the screens, picking tables, etc., and the large Capel ventilation fan is driven by a 95 h.p., 2200 volt Allis-Chalmers-Bullock direct connected motor.

Development work is being rapidly pushed ahead at this mine and a lot of new coal cutting and hoisting machinery is soon to be added with a view to doubling the present output. All of this new equipment will be electrically driven.

Taken altogether this plant is one of the most interesting, both in point of construction and application, in the Dominion.

MISCELLANY

The street railway system of Edmonton has at last turned the corner and it is believed that deficits are a thing of the past. The last few months have shown large and regular gains in receipts which, with the present activity in all industrial lines which Edmonton is experiencing, there should be no difficulty in maintaining. During the present year large extensions are being made to the lines as follows: Spruce avenue extension, three-quarters of a mile; double tracking city park extension, one mile; Jasper avenue to Alberta avenue extension, one and a quarter miles; 8th street to 24th street via Vermilion avenue, two miles; Whyte avenue east to the Roman Catholic College, one mile; from Whyte avenue up 5th street west to the high level bridge, one-half mile. As soon as the high level bridge is completed the tracks will be laid across and connection made with the present line on 9th street.

Battleford

Owing to the rapid growth of the town of Battleford it has been necessary to plan for extensions to the electric lighting plant. To this end it has been decided to add two new units of 200 kw. capacity each. Contracts have already been let for the engines which will be manufactured by Mirreles, Bickerton & Day of Stockport, England. Purchase was made through the Canadian agency for this firm, the Canadian Boving Company. Tenders will be called for the generators and switch board equipment in the near future. The plans were prepared and tenders are being called by the town electrician, Mr. F. K. Martin.

Saltcoats

The town of Saltcoats, Sask., has followed the lead of a large number of smaller western municipalities, and installed a municipally owned and operated electric light and power plant. The present installation comprises a 40 kw., 2300 volt, three-phase, 60 cycle, Canadian Westinghouse generator and switchboard, the generator being belt-driven from a 63 B.h.p. Tangyes gas engine coupled to their standard suction gas producer for using Pennsylvania coal. This was installed by the Brydges Engineering and Supply Company of Winnipeg. The distribution system is being installed by Enoch Smith, of Melville.

Melville

An addition has been made to the Melville, Sask., municipal plant of a 200 h.p., three cylinder, vertical gas engine and producer gas plant direct coupled to a Swedish General Electric 2300 volt, 3-phase, 60 cycle generator, and Swedish General Electric switchboard. The installed capacity of this situation is now 282 h.p., all in producer gas engine. The engine and plant is of Tangyes make and installed by the Brydges Engineering and Supply Company.

Moose Jaw

A disastrous fire in the early morning hours of May 25 destroyed the municipal power plant at Moose Jaw. This is also the waterworks plant for the town, and very creditable speed was made in making temporary arrangements for the supply of water, and power for lighting.

Berlin

The town of Berlin has placed an order for the first 50 of their street lighting poles; the type is a No. 1 Jandus pressed steel pole, which will be used to light a residential street, namely Queen street in Berlin. This pole will carry one 250 watt tungsten lamp enclosed in a 16-inch diameter

Alba globe. The lamps will be connected in multiple and served by an underground service. The contract for the supply of these poles has been awarded to the R. E. T. Pringle Company.

How an Organized Attempt to Bring on a Strike was Foiled by Fair Treatment of Employees

The Electric Railway Journal publishes the following description of an unsuccessful attempt to tie up, by a strike, the lines of the Milwaukee Electric Railway & Light Company:—"Upon the appearance of the Amalgamated organizer in Milwaukee last December the management took steps to meet and counteract his activities at every step. His efforts to stir up trouble among the trainmen were made fully known to the public, and they and the trainmen were fully advised as to the methods of the organization and the results of its work in other cities. So far as there was any complaint among the men or anything more which the company could do for them, the cause for complaint was removed, and the company showed in many practical and substantial ways its interest in the welfare of its employees. Five months' effort had gained for the cause of the union but few adherents. Nevertheless, there were constant boasts as to the hundreds of car-men who had joined and almost daily threats of the dire results that would follow a refusal to "recognize the union." At no time did the company attack unionism. It simply refused to have any agitators in its employ or to confer with their representatives, and the union threats and demands were met by unfaltering refusal to entertain them in any way. When the union organizer was finally forced to action rather than to interviews, it developed that only twenty-six men were sufficiently unionized to answer the strike call. The press and public, thoroughly informed as they were as to the merits of the controversy, lent no aid to the strike, and even organized labor quickly abandoned its support. There was no strike worthy of the name in Milwaukee, because the railway management made careful and intelligent provision against trouble, not by plans for running its cars if its men went out, but by making it reasonably sure that they would not strike because they had no reason to do so. With a body of employees that has been treated fairly and considerately and a public opinion convinced that this is the case, it has been shown in Milwaukee that street railway labor troubles are not to be feared, because they can be wholly avoided. The city, no less than the railway company and its men, is to be congratulated upon the result."

Use of Oxy-Acetylene Flame on Track Work

The Brooklyn Rapid Transit Company is now relaying its tracks on Fulton street between Vanderbilt and Reid avenues, a distance a little over two miles of double track. As the track was installed with either electrically welded or riveted joints, it is practically in one piece for its entire length except where broken by special work. The specifications under which the work is being done call for the removal of the rail in lengths of 25 ft. or 30 ft. so that there will be no trouble in handling it.

The usual way for separating the rail into the proper lengths would be by cutting it with hack saws, but Contractor Sigretto, who is doing the work, has found a quicker and easier way of doing this. Instead of eight or ten men using hack saws, which would cover considerable distance and prevent the track layers from closely following the men opening up the old track, all of the cutting is being done by one man with an oxy-acetylene torch and his helper.

Ottawa—The Electric Capital of Canada

Detailed Description of the Electrical Features of the Chateau Laurier where the C.E.A. Convention will be held

The members of the Canadian Electrical Association who are planning to attend the Ottawa convention this month, will naturally be considerably interested in knowing something about the hotel which will form the headquarters of the association during the Big Week. Some of them, no doubt, have heard that the hotel accommodations in the Capital were somewhat inadequate for such an occasion. It cannot be gainsaid that this has been the case to a great extent up to the present time—it has been the one great drawback to Ottawa's success as an ideal convention city. But this condition exists no longer. On the 24th of May the doors of the Chateau Laurier were opened and in it Ottawa can boast of a hostelry that is second to none on the continent. Situated in a beautiful park, it commands a magnificent view of the Parliament Buildings, with the broad Ottawa in the middle distance and the blue Laurentians fringing the horizon. The main entrance faces one of the busiest spots in Ottawa, while directly opposite and connected to it by tunnel is the magnificent new Grand Trunk station.

An adequate description of this latest addition to Ottawa's collection of stately edifices would occupy more space than is possible to give to it in this issue, and this article will be confined to a very general description of the electrical equipment only.

Fed from G.T.R. Steam Plant

The electrical energy is obtained wholly from the Grand Trunk Railway's own steam power plant situated just south of the new station. It is all direct current, 220 volts and 110 volts brought in, underground, to the switchboard room in the basement of the hotel. The lighting, which is three-wire, 110/200 volt, occupies three panels, and the power, which is all 220 volt, takes up three more. Integrating wattmeters record the amount of energy consumed in each department, thus giving a check on the extravagant users of power among the employees. An extra panel is fitted up with indicating meters for water pressure, steam pressure drive for the refrigerating system, compressed air, temperature, etc. The switchboard equipment is C. G. E. manufacture.

97 Motors Installed

There are in all some ninety-seven motors, ranging from 3 h.p. to 70 h.p. and totalling about 1500 h.p. in rated capacity. There are four 50 h.p. motors driving the large ventilating fans which draw in and expel about 200,000 cu. ft. of air per minute. The incoming air is first washed by passing it through large spray tanks and then warmed by passing over heated coils. The temperature at which it is delivered is automatically regulated by a system installed by the National Temperature Regulator System of New York. It can be adjusted for regulation at any desired temperature.

There are in all 10 motor-driven elevators, 3 passenger and 7 freight. The passenger elevators are roomy and richly finished and all provided with fool-proof doors. Their carrying capacity is 3000-3500 lbs. The seven freight elevators have capacities varying from 1000 lbs. to 2½ tons. They can be operated from any floor by means of push buttons. All elevator motors have been put in by the Otis Elevator Company.

The laundry, which is amply equipped with the very

latest machinery, is run entirely by individual drive, requiring sixteen motors varying from ½ h.p. to 10 h.p. Among the great number of machines which are also driven electrically are the printing press, dough-mixers, meat-choppers, dish-washers, bread-crumbers, ice cream freezers, potato-peelers, etc., etc.

There are 58 vault-type refrigerators run by the brine system, which is operated from the power house.

One large Dunn vacuum cleaner takes care of the whole building, being situated in the switchboard room and driven by a Canadian Westinghouse, 80 h.p. motor. This operates by sucking the dust down to a receptacle where it is mixed with water and the whole pumped into the sewer, thus obviating the necessity of having to shovel out the dry germ-laden dust every few days.

All clocks are electrically operated and controlled by a master clock which is to be connected with the standard clock at the Dominion Observatory. The batteries for the clock system are in the main battery room, which also contains the batteries for the call bells, elevator bells, fire alarm system and telephone system. There will be 368 phones on the hotel's private exchange.

Lighting

The hotel is wired for 22,200 lights, which would easily total over a quarter of a million candle-power—enough to illuminate a small city. The lighting is all on the indirect system and it can safely be said that the fixtures are quite in keeping with the all-round magnificence of the hotel. Besides the elaborate fixtures in the public reading and writing rooms, there are plug sockets all along the walls and in the floor to which any desired number of individual lights can be attached. The same system is applied in the bedrooms, portable extension lamps being provided for each room.

The public rooms and corridors are furnished in various styles, Louis XIV, Louis XVI, Queen Mary, Elizabethan, Colonial and Modern, and in every case special fixtures have been designed to completely harmonize with the surroundings.

It is particularly fitting that the Canadian Electrical Association should be one of the first to hold a convention in this beautiful hotel, in which electricity plays such a prominent part. The visiting members will find in Mr. T. H. Finch, the electrical engineer, a genial and well informed guide and source of information.

The Power Situation in Ottawa—Many Plants Clustered Around the Chaudiere Dam—City in Fortunate Position

That cheap water power constitutes a prime attraction in the industrial development of a city is shown by the fact that every unit available, under present storage conditions at this point of the Ottawa River has been placed under control by manufacturers and operating companies in the cities of Ottawa and Hull. As may be seen from the accompanying sketch, most of the generating stations supplying power in Ottawa are situated around the Chaudiere Falls. The Hull Electric Railway power house (not shown in sketch) is at Deschenes, about six miles above the Chaudiere, while the W. C. Edwards & Co. plant is situated beside the Rideau Falls where the Rideau river empties into the Ottawa, about two miles below the Chaudiere.

The E. B. Eddy Co., though at present under the necessity of buying some power, will have ample capacity to sup-

ply all their needs on the completion of their new plant, now under construction.

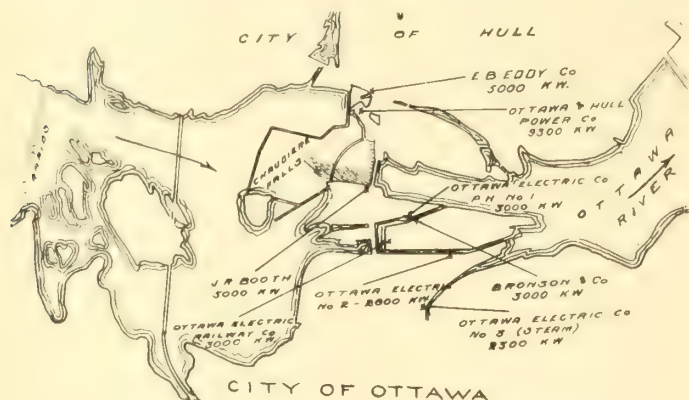
J. R. Booth's plant generates power for use in his immense saw mills and pulp mills.

The Ottawa Electric Railway will soon install a steam unit to supplement their hydraulic equipment now in use.

The Ottawa and Hull Power Company supplies power to the Ottawa Municipal Electric Department under an agreement with the Hydro-electric Commission of Ontario, and also to the Portland Cement mills in Hull.

The Ottawa Electric Company owns three power plants, two hydraulic and one steam. It is adding to its steam equipment for the purpose of handling peak loads.

There is still however a vast amount of power undeveloped immediately above Chaudiere Falls, and only waiting



Map showing location of different water plants

for increased demand to be turned into electrical energy. Immediate control of the present supply is obtained by means of an arched dam above the head of the Falls, and extending from shore to shore. Storage dams built and being built by the Government at the head waters of the Ottawa will insure a good yearly average discharge. Thus it can be seen that Ottawa is in a very fortunate position with regard to sources of power, and though it may not have "more power than Niagara," it has sufficient to amply supply its needs for many years to come without having to depend on coal.

The New Power Plant of the E. B. Eddy Company—One of the largest private industrial plants in the world

The E. B. Eddy Company, one of the biggest industrial concerns in Canada, in order to keep pace with its ever-increasing business, has decided to erect a hydro-electric power plant which when completed will be one of the largest self-owned industrial power plants in the world. Excavation has already been made and the concrete retaining walls built for the generating station, which is expected to be in operation in a little over a year.

This company is a pioneer in the application of electric drive to paper making machinery, being the first in Canada to do so and for twelve years have had excellent satisfaction from all such installations. At present the water-driven apparatus consists of three 100 kw., 125-volt d.c. generators, which supply power for twenty-five small motors and for lighting, while a considerable part of the machinery is directly driven by water wheels. Apart from this the company is forced to expend annually about \$30,000 for power, obtained from the Ottawa and Hull Power Company and from the C. P. R. generating station at Deschenes. The new plant will obviate the necessity of purchasing power from outside sources and will centralize the entire water power system of the company.

Operating under a 32-38 foot head a development of

12,500-15,000 h.p. will be obtained. Three units will be installed consisting of three Allis-Chalmers-Bullock horizontal turbines direct-connected to three Swedish General Electric, 3750 kv.a., 2300-volt, 3-phase, 60 cycle, 164 r.p.m. generators. Exciting current will be obtained from two 100 kw., d.c. generators running at 450 r.p.m.—one turbine and one motor driven. In a separate transformer house will be two 1,000 kw. transformers stepping down from 2300 to 440 volts for supplying energy to the smaller motors. They are to be provided with the "Scott tap," converting 2-phase to 3-phase power, in order to handle the 2-phase energy supplied by outside sources until the new plant is in operation.

A very formidable array of induction motors is also to be installed, consisting of four Canadian Westinghouse 1200-h.p., 2300-volt, 3-phase, 60-cycle, wound-rotor units running at 240 r.p.m. and direct-connected to large pulp wood grinders; also one 500 h.p., one 300 h.p. and two 200 h.p. Canadian Westinghouse 2300-volt, 3-phase, 60-cycle, wound-rotors. All of the above eight motors will have starting apparatus specially designed by the Canadian Westinghouse Company. Besides these there will be forty motors ranging from 150 to 30 h.p. of squirrel-cage type, 440-volt, 3-phase, 60-cycle. Of these, twenty-three will be supplied by the Canadian General Electric Company and the remainder by the Canadian Westinghouse Company. The d.c. generators in use at present will be utilized to supply energy for variable-speed d.c. motors.

The consulting engineer for the project is Mr. Wm. Kennedy, Jr., of Montreal, with Prof. L. A. Herdt, of McGill University, acting in an advisory capacity. Mr. Bradley is superintending the excavating and concrete work for the E. B. Eddy Company, and Mr. W. C. Baldwin is the electrical superintendent.

Hull Electric Railway—A city and suburban line — Serves beautiful resorts along north shore—Generate own power

The visiting members to the coming convention of the Canadian Electrical Association to be held in Ottawa need have no misgivings as to the adequacy of the transportation facilities in the Capital and vicinity. Ottawa is truly said to be one of the pioneer Canadian cities in the matter of electric traction. The Ottawa Electric Railway on the Ontario side of the Ottawa River, and the Hull Electric Railway on the Quebec side, are so extended as to take every advantage of the famous natural beauties of the district as well as to take ample care of the ordinary transportation requirements of the population.

The Hull Electric Railway generates its own power at Deschenes, a point on the north shore of the Ottawa river about seven miles above the city. Here a high water head of 10 ft. and a low water head of 7 ft. 6 ins. is available at the turbines. The generating equipment comprises two 800 kw., 10,000-volt, 3-phase alternators; two 350 kw., d.c. generators; one 250 kw., d.c. generator and two 150 kw. monocylic machines. The distributing plant includes two substations, one at Hull, and one at Aylmer. The Hull station houses one 250 kw., 2,200-volt, 3-phase induction motor and one 250 kw., 2,200-volt, 3-phase, synchronous motor, each driving a 600-d.c. generator. The synchronous motor-generator set is now being installed by the Canadian General Electric Company. The Aylmer station contains one 250 kw., 2,200-volt, 3-phase induction motor driving a 600-volt, d.c. generator. Besides having extensive car barns and repair shops at Deschenes the company is erecting new car barns, 288 ft. x 40 ft. on Chaudiere street, Hull, capable of housing twenty-seven 30-ft. cars for urban service.

The rolling stock consists of 41 passenger cars, three locomotives, two ploughs, 3 sweepers, 1 baggage car, 1 work

car and one parlor car. This includes 6 new single-end, straight-platform, p.a.y.e. cars, 51 feet over all, and 5 p.a.y.e. trailers. On these the Westinghouse S.M.E. air brake system, and Westinghouse automatic car and air couplers are installed.

The parlor car is the last word in luxury and privacy on an electric road. It is furnished with 16 moveable cushioned wicker arm chairs as well as vestibule seats. The interior furnishings are rich and tasty. This car is featured for private parties, after theatre, or dinner or supper at the Country Club or Golf Club which are situated on the line at some distance from the city.

The Ottawa terminal of the line is under the terrace of the new Chateau Laurier, entrance being gained to the

ture transportation requirements and to the relief of present traffic congestion. Extensions are in charge of Superintendent M. J. Hutcheson.

At the present time Sparks street has to bear the brunt of accommodating every line in the city for a distance of three blocks. To better these conditions a double track is to be laid on Queen street east, the first south of Sparks street, from Bank to Elgin, forming a by-pass, as it were, for most of the eastbound and considerable of the westbound cross-town traffic.

On Preston street in the west end of the city a double track will be laid from Somerset street to the Experimental Farm, a distance of about a mile. This will be linked up to the lower town line by means of an extension from the C.P.R. station along Broad and down Queen street west to Bridge street, forming a through run from the extreme north-east to the extreme south-west corners of the city. A loop line about two miles in length will be run through the most populous section of Ottawa South, one of the newer and most rapidly growing parts of the city. This will connect with the Bank street line.

In addition to the above, temporary tracks are to be laid immediately on Wellington street to handle the Sparks street traffic pending the completion of the southern half of the Plaza and the repairing of Sparks street, the city's main thoroughfare.

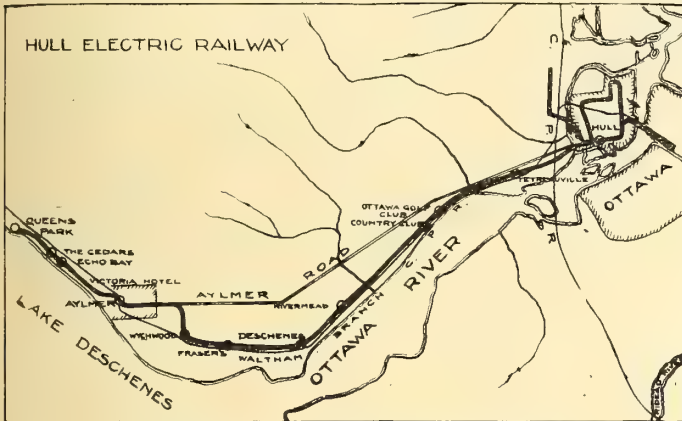
To keep pace with these extensions and to better the service generally, the company has ordered ten new cars from the Ottawa Car Company for autumn delivery. These will be steel bodied, forty-five foot, p.a.y.e. cars, up-to-date in every particular, with center aisles, cane front-facing seats, individual stop-bells, front exits, etc. Motors, controllers, air-brake system, etc., will be of Westinghouse manufacture. In addition to the regular electric heaters they will be equipped with auxiliary hot air heaters for use in extremely cold weather. These cars will cost in the neighborhood of \$8,000 each.

In their power house at the Chaudiere, the Ottawa Electric Railway Company will soon have installed a new steam unit consisting of a Canadian Westinghouse 3200 kw., 2200-volt, 2-phase, 60-cycle alternator, direct-connected to a Westinghouse 3200 kw. steam turbine. This will supply energy for their a.c.-d.c. motor-generator booster sets located at outlying points on their suburban lines.

More power for Ottawa—The present possibilities to be doubled—First step towards a ship canal

No city in America is more favorably situated in the matter of abundant water power close at hand than the city of Ottawa. The drainage basin of the Ottawa river is in the neighborhood of 45,000 square miles and the length of the river over 450 miles. This river at the present time has a minimum flow of 11,000 c.f.s. at Ottawa. At the Chaudiere Falls a modern concrete dam located within the limits of the twin cities of Ottawa and Hull creates an available head of about 30 ft., giving an average of (say) 60,000 h.p. and a minimum of about half this amount. In addition, some three miles up river, at Deschenes, there is an 8½ foot fall, partly developed, while between this point and the city there is a series of little rapids giving a total fall of about 11 or 12 feet.

One of the main difficulties in the way of further hydraulic power development has been the irregular flow of the Ottawa river which varies from the minimum of 11,000 c.f.s. mentioned above to a maximum of about 100,000 c.f.s. To remedy this condition, in part, the Dominion Government is constructing regulation dams at the foot of Temiskaming Lake, at Kippewa Lake, at Lake Expanse and



Showing lines of Hull Electric Railway

city over the Interprovincial (Alexandra) bridge. At this Chateau Laurier or Plaza terminal, incoming and outgoing subway platforms are to be erected on each side of the tracks, thus avoiding confusion and chance of accident.

Across the river in Hull (Pop. 17,000) a belt-line and C.P.R. station service is given by a number of small urban type cars. Large double-truck cars take care of the through passenger traffic from Ottawa to Queen's Park, Aylmer, a distance of over twelve miles. This line skirts the north shore giving a magnificent view of the beautiful Parliament Buildings. Points of interest along the route are: The E. B. Eddy Co.'s plant, Country Club, Golf Club, Deschenes Rapids, Rivermead Golf Club, Aylmer (Pop. 4,000), Hotel Victoria (a very popular summer resort), the Cedars and Queen's Park, a site of great natural beauty on the shores of Lake Deschenes. This park is an ideal spot for picnics, bathing, boating and amusement; many features such as roller rinks, moving picture shows, miniature railways, &c., having been introduced by the company.

Mr. G. Gordon Gale is superintendent of the company and under his efficient management it has kept pace with the rapid development of the centres of population which it serves. A good service is always maintained and courtesy on the part of all employees is always insisted upon.

The Ottawa Electric Railway—Making additions to lines, rolling stock, generating equipment—Use steel bodied cars

The coming summer will see considerable additions to the lines of the Ottawa Electric Railway Company. As a result of several joint conferences between the municipal Board of Control and the Railway officials it has been decided to go ahead with extensions in various sections of the city which will total about four miles and a half of single trackage. The routes decided upon were adopted only after the fullest consideration had been given to present and fu-

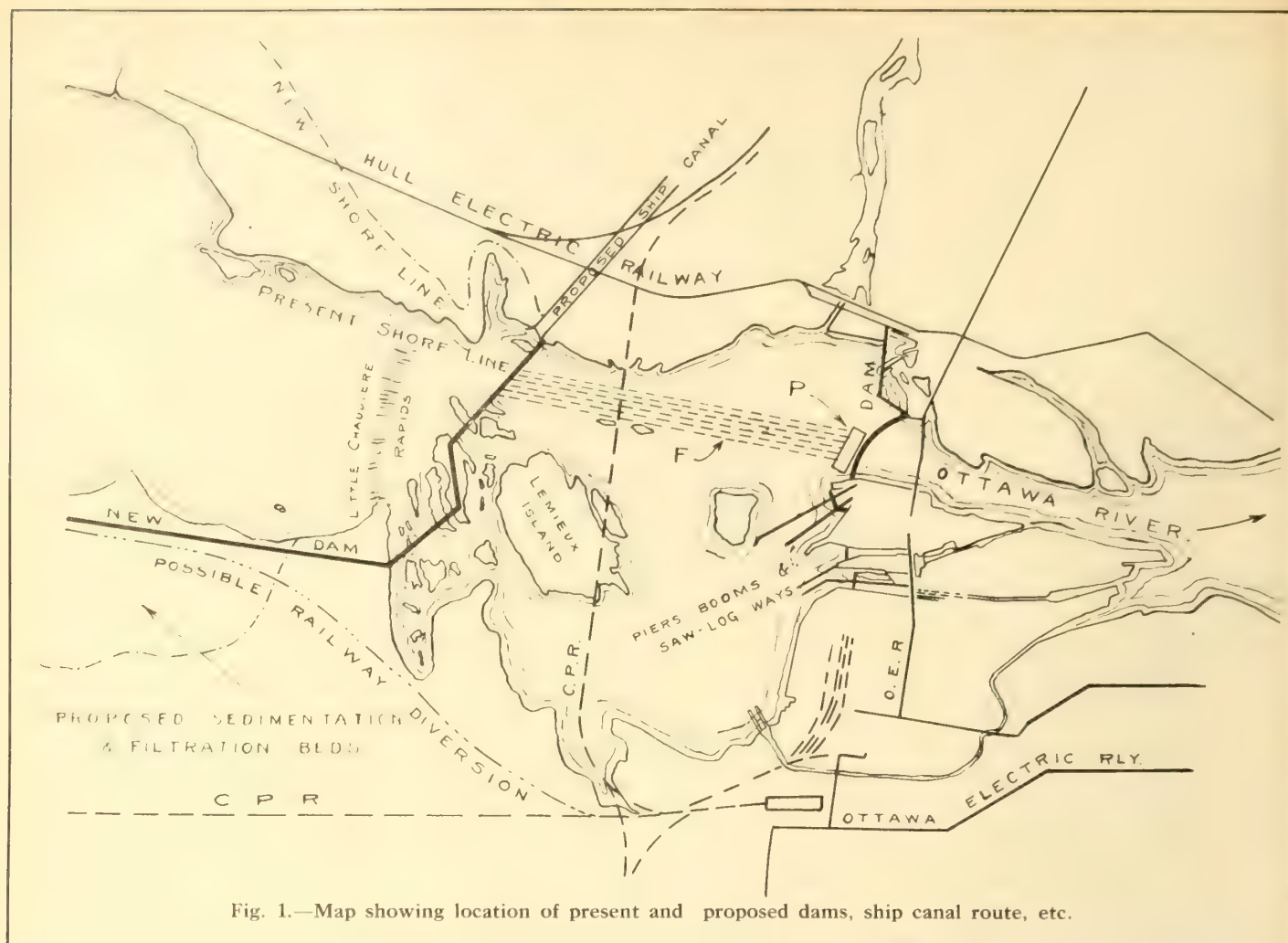


Fig. 1.—Map showing location of present and proposed dams, ship canal route, etc.

at Lake Quinze, and other dams are planned, not only in this connection, but having in view the rendering of the Ottawa river navigable and the ultimate construction of a ship canal via this river from Montreal to Georgian Bay. These dams contemplated and under construction will, with the canalized river, increase the minimum flow to 28,000 c.f.s.

In this connection what seems to be a thoroughly feasible development scheme that would be the means of supplying Ottawa with a minimum hydraulic capacity of at least 125,000 h.p. and at the same time form an integral part of the Georgian Bay ship canal plan, has been conceived recently by Mr. Noulan Cauchon, a consulting engineer of Ottawa. Mr. Cauchon's plan will be better understood by reference to the accompanying drawing. The present Chaudiere dam is indicated by the curved line shown near the right-hand side of the map and just west of where the line of the Ottawa Electric Railway crosses the river. The general plan of this dam is shown in Fig. 2. At this point there is a fall of about 30 ft., and all the power available is being used by some five or six different companies who have installed generating equipment up to and, in some cases, beyond the minimum capacity of their share of the flow.

In order to bring the level of Lake Des Chenes to Ottawa over the Little Chaudiere and intervening rapids and to develop all the river power available, Mr. Cauchon claims the dam which was anticipated at the rapids as a part of the Georgian Bay Canal scheme should be constructed now as an economic conservation and power proposition on its own merits. This dam, just below the rapids, would raise the water at this point by some 20 feet and would not only drown out the Little Chaudiere rapids, but

also the $8\frac{1}{2}$ ft. fall at Des Chenes, some three miles up stream. The new dam is shown to the left of figure 1; also a dike extension some distance westward along the Ontario side of the river. In addition to providing this substantial head a large flooded area on the Ontario side of about 300 acres would be available for sedimentation basins to be used for the Capital's water supply.

If this new dam then, with a 20-ft. head, be constructed, there would be with 28,000 c.f.s. discharge a minimum development of about 45,000 electrical h.p. Under the same conditions of discharge control the power at the present Chaudiere dam would be increased to about 68,000 h.p., making a total for the city of 113,000 electrical h.p. Mr. Cauchon's plan further contends that the ideal development of these two powers would be by combining all the present power at the Chaudiere dam and the power to be developed at the new dam in one power house situated at the present Chaudiere falls (indicated in the map at P). To accomplish this the water would be carried by flumes or penstocks F, from the upper to the lower dam and about 5 feet would thus be saved, making a total calculated head of 55 ft. With the regulated minimum discharge of 28,000 c.f.s. this would produce about 126,000 electrical h.p., which could be considerably increased for a very large portion of the year, and permanently so by an extension of the Ottawa river regulation scheme. For purely power purposes the dam could advantageously be further up stream than where now proposed but it is desirable that the lines of the Georgian Bay Canal dam be followed in order that it may be an integral part of that scheme when the latter materializes.

As shown on the map, the outlet of the canal would be on the Quebec side of the Ottawa river. The ships would



Fig. 2.—Chaudiere Dam across the Ottawa River where large electric plants are installed

be lowered by one or more locks in this canal to the level of the river below the twin cities and would meet the Ottawa at a point just about opposite the Rideau river. In connection with his plan Mr. Cauchon also proposes to associate a scheme for diverting the present line of the Canadian Pacific Railway through the western part of the city to a new course close to the river and parallel to the extension before mentioned, of the dike portion of the new dam as shown in the map. This section of the dam is designed, as stated above, to serve the purpose of a retaining wall, the flooded area so set off from the river to be used for sedimentation basins.

SUMMARY

Name of power site	Minimum Discharge c.f.s.	Effective head	E. H. P.	Remarks
1. Low water development under present conditions—no regulation of river				
Chaudiere Falls	11,000	30 ft.	27,000	Wheels and dynamos for 57,250 e. h. p. installed.
Des Chenes	11,000	8 1/2	7,650	3,000 developed by Hull Electric Co.
2. Regulated low water development—canalized river and storage				
Chaudiere Falls	28,000	30	68,000	
Des Chenes		none	none	Transferred to new conservation dam.
New Conservation Dam	28,000	20	45,000	
Combined Powers	28,000	55	126,000	Head from regulated conditions of 195 feet level above New Dam and 140 ft. below Chaudiere.

NOTE :—Drainage area above Chaudiere 34,623 sq. miles.
Maximum discharge in 1876 193,000 c.f.s.
" " 1905 87,000 "

Under the conditions of carrying the joint power in penstocks from the new to the old dam it would be possible if desired to drain the area between the two dams.

An alternative plan has been suggested by one of the power owners for raising and widening the present Chaudiere dam to the proposed level of Mr. Cauchon's scheme. This would entail enormous retaining walls completely surrounding the basin between the present Chaudiere dam and the Little Chaudiere rapids to prevent submersion of large parts of Ottawa and Hull. The great objection to this plan seems to be the enormous cost of these retaining walls without other advantages than those attained by the first scheme.

Ottawa Electric Section of the C. E. A.—Club Room Supplied by Company—Entertainment and Instruction Intermingled

There has been of late years a marked tendency on the part of large firms of the enterprising type, to go considerably beyond the absolute requirements in responding to needs on the part of their employees which are outside the daily routine of business. This tendency has manifested itself chiefly in the provision of places or opportunities for amusement and recreation, and wherever a company's interest in its employees has been shown in this way, the result has been unfailing success. Too much cannot be said of the moral effect of the realization on the part of the employees that "the firm" does not look on them as mere machines but is willing to minister to their capacity for healthy recreation as well as to that for work.

The Ottawa Electric Company, through its general superintendent Mr. A. A. Dion, has placed itself in the forefront of progressive corporations in providing for the entertainment of its employees. In September of last year Mr. Dion called a general meeting of the employees of the company and asked for expressions of opinion as to the advisability of forming a company section of the Canadian Electrical Association. The response was unanimously in favor of doing so, and the section was formed with an initial membership of seventy-five, under the presidency of Mr. C. G. Keyes. The company immediately decided to place a club room at the disposal of the members, and furnish it as such. The top flat of the new substation was given over for this purpose and afforded a hall 90 ft. long and 35 feet wide. Two bowling alleys, a pool table and billiard table were installed as well as card and reading tables, supplied with electrical and other publications. A platform and blackboard were erected and arrangements made for supplying a.c. and d.c. current to a demonstrating table. Semi-monthly meetings have been held interspersed with several social evenings at which music, refreshments and "the smokes" were plentifully forthcoming. Among those who addressed meetings during the season were Mr. A. A. Dion, president of the C.E.A.; Mr. John Murphy, electrical engineer for the Railways and Canals Department; Mr. Lambe of the Government Electrical Standards Laboratory, and Mr. D. R. Street, secretary-treasurer of the Ottawa Electric Company. An extremely interesting and instructive "composite paper" was also given, the superintendent of each department of the company contributing a ten minute talk on the work under his supervision.



Ottawa Electric Company Section of the Canadian Electrical Association

The appreciation of the company's efforts has been shown by the fact that the membership of the section has increased from seventy-five to over one hundred and ten, and that all meetings have been very well attended, the members entering most actively into the discussion following the different papers. Our cut is from a flashlight taken in the club room on the last social evening of the season.

The Electric Wizard of Ottawa—Inseparably Associated with Every Electric Public Service Corporation in his City

From the day when the first electric car was sent out over Ottawa's streets to the present moment, no man in Canada has shown greater confidence in the ultimate triumph of electric power as the prime mover in every form

of industrial development than Mr. T. Ahearn, of Ottawa. It was with many misgivings in the early eighties that an electric street railway system was established; at least every one but Mr. Ahearn had misgivings that the severity of the climate and the fact that the electric industry was in its infancy might prove too great an obstacle to the successful operation of this new venture. The pioneer work of Ahearn & Soper has, however, been justified, and Ottawa stands to-day, largely as the result of this firm's tangible support of electrical industries of every sort, one of the best equipped, if not the best equipped, electrical city on the continent.

That Mr. Ahearn's interest has been more than sympathetic is shown by the fact that he has been largely instrumental in the financing of most of the large electrical enterprises in Ottawa. At the present time he is president of the Ottawa Electric Railway Company, of the Ottawa Car Company, of the Ottawa Gas Company, of the Ottawa Electric Company and of the Ottawa Light, Heat & Power Company, the latter a holding company for the Gas and Electric Companies previously mentioned.

Ottawa Municipal Operations—Power Received through the Hydro-Electric Commission from the Ottawa & Hull Electric Co.

The municipality of Ottawa purchases power from the Ottawa & Hull Electric Company through the Hydro-electric Power Commission of Ontario. It has recently been decided to place all wires in Ottawa under ground. This project calls for two concrete tunnels under the sidewalk, one on each side of Sparks street, 6 feet high and 4 feet wide, with manholes at street intersections. The arrangement is to give the Ottawa Electric Company one side of each tunnel and the Municipal Electric Department the other side, while the C.P.R. will string its telegraph wires along the roof. The high tension primaries of the electric companies and the feed wires of the street railway company will be laid in conduit in the floor of the tunnel. Ventilation will be secured through the lamp standard bases.



Mr. T. Ahearn

Power Development on Trent Canal

The Government Dams Being Also Utilized for Electric Power Purposes—Detailed Description of Modern Plant Now Operating at No. 2

By A. H. Hull and K. R. McKinnon

The construction, by the Government of the Dominion of Canada, of the Trent Canal with its various dams and locks, has opened the way for the development of the water powers along its route. In the Trenton district, on Section 1 of this canal, a number of dams have been constructed and already a power station is in operation at Dam No. 2 at Trenton, while a second one is in course of construction at Dam No. 5 at Frankford, with a third to be erected presently at Dam No. 1 in Trenton. Fig. 1 shows the district around Trenton and the location of these dams.

At Trenton is situated the old electric water power plant of the Trenton Electric & Water Company, which was

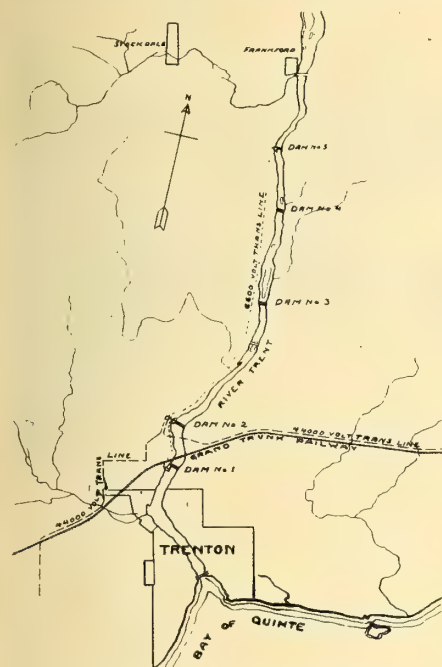


Fig. 1—District around Trenton

crosses the river at Trenton. This dam has been superseded by the new Government dam known as Dam No. 1, which is situated slightly south of the old dam.

The old development consisted of an open flume leading to the power house a short distance below the west end of the dam and the water, after passing through the turbines was discharged into the river, giving a head of 14 feet. The power house building was of frame construction and contained, at one end, two 60-inch Crocker vertical water wheels, of Jenckes manufacture, geared to a horizontal shaft which was directly connected through a flexible coupling to a 250 kw., 200 r.p.m., 3-phase, 60 cycle, 2300 volt generator of the Canadian General Electric Company's make. A belted exciter was driven from an extension of the generator shaft. This unit was installed about 1900. The other end of the building contained two 52-in. Boss turbines made by the Wm. Hamilton Manufacturing Company. These were connected through gears to a horizontal shaft from which was belted a 150 kw., 600 r.p.m., 3-phase, 60 cycle, 2300 volt revolving armature generator, also of C. G. E. manufacture. A belted exciter completed this unit which had been in service since about 1896. The switchboard was of old construction and the switches were all knife switches.

From this plant the town of Trenton was supplied at 2300 volts with energy for lighting and power purposes. A small brick sub-station, close to the power house, contained six 100 kw., self-cooled, oil-insulated, single-phase, C.G.E. transformers which raised the voltage from 2300, to 11,500 volts for transmission over a single circuit pole line about twelve miles to Belleville. At Belleville, the voltage was reduced to 2300 volts for distribution. A steam plant at Belleville containing two belted units of 150 kw. and 300 kw. capacity was used to carry the peak loads and for emergency operation.

This old plant at Trenton will shortly be torn down to make way for a new station of 3,000 kv.a. capacity located a short distance below the new dam. This new station will be erected by the Sidney Electric Power Company and will operate under 17 feet head. From this station power will be distributed in Trenton at 6600 volts, 3 phase and at 4160/2400 volts, four wire, three phase by the Trenton Electric and Water Co. to supply its lighting and power customers and for the motor-driven pumps which supply pure spring water to the town waterworks system which is owned and operated by the company. This station will operate in parallel with the power houses at Dams No. 2 and No. 5 through the transforming station at Dam No. 2, so that the load in Trenton may be carried by any one of three power houses, or else by power supplied over the 44000 volt transmission lines from other generating stations on the Electric Power Company's system, thus assuring the power users in Trenton a continuous supply of power from four different sources.

Two 6600 volt, three-phase circuits will connect this station with the Sidney Electric Power Company's transforming



Fig. 2—General View at Dam No. 2

station at Dam No. 2, which will be described later. These circuits will be arranged so that power may be delivered to or received from the transforming station. Room will also be provided in the vicinity of this power house for the installation of a testing station where oil, insulators, meters, etc., may be thoroughly tested.

At Dam No. 2, about one mile north of Dam No. 1, a generating station has been built by the Sidney Electric

Power Company and has been in operation since August, 1911, supplying power to Trenton and also to the transforming station situated across the roadway. A view of the river at this point is shown in Fig. 2.

Fig. 3 shows a closer view of the buildings from the down-stream side. The dam here, as at No. 1, is of con-



Fig. 3—Dam, Power House and Transforming Station

crete and consists of ten spillway sections, each 25 feet wide and provided with stop-logs. The piers between the sluices are eight feet in width. A concrete platform spans the spillway section and is provided with a track for the stop-log winches. This dam provides for a regulated head of 20 feet.

The generating station is located at the west end of this dam, the canal lock being at the east end. In order to provide sufficient spillway area for the heavy spring floods which occur on this river, it was necessary to construct the station completely inside the shore line, Fig. 4. The forebay, in plan, is a quadrant of a circle with the rack platform running up-stream along the shore line and almost at right angles to the dam. The circular side of the forebay consists of a concrete retaining wall, with a back-fill forming a roadway to the power house.

At the entrance to the wheel-pits, stop-log gains are provided, in line with the gains on the Government Dam. The generating station is built on the piers containing these gains, forming an extension to the dam. The sub-structure is of reinforced concrete, while the superstructure consists

of steel columns supporting the roof trusses and crane girders, with walls of red pressed brick. Steel sashes were used for the windows, with large vent areas for ventilating purposes. A 48-inch motor-driven fan is also installed in the east end of the power house, near the roof, to assist in the ventilation of the building. There are four bays, one for each of the main units with a fifth for the exciter unit and erecting space. Each bay is 22 feet long, making a total inside length of building of 110 feet. The width is 30 feet, except for two of the bays, where the width is increased to 43 feet, in order to provide space for the switchboard and switching equipment. Beneath these extensions, room is provided for two motor-driven pumps, an air compressor and tank, work room, lockers and lavatory. A plan and cross section of the building are shown, Figs. 5 and 6.

The thrust deck is eight feet below the main generator floor and carries the weight of the rotating parts of the machines. The draft tubes are of concrete and form part of the power house substructure. They are elliptical in shape at the point where the turbine discharges into them, and



Fig. 4—The Forebay is a Quadrant of a Circle

gradually flare out to a square section at the tailrace piers, so that the water flows from the wheels to the tailrace at a uniformly decreasing velocity without any sudden change of section. Stop-log gains are provided in the tailrace piers for unwatering purposes. The tailrace was excavated out of the river bank, in much the same manner as the fore-

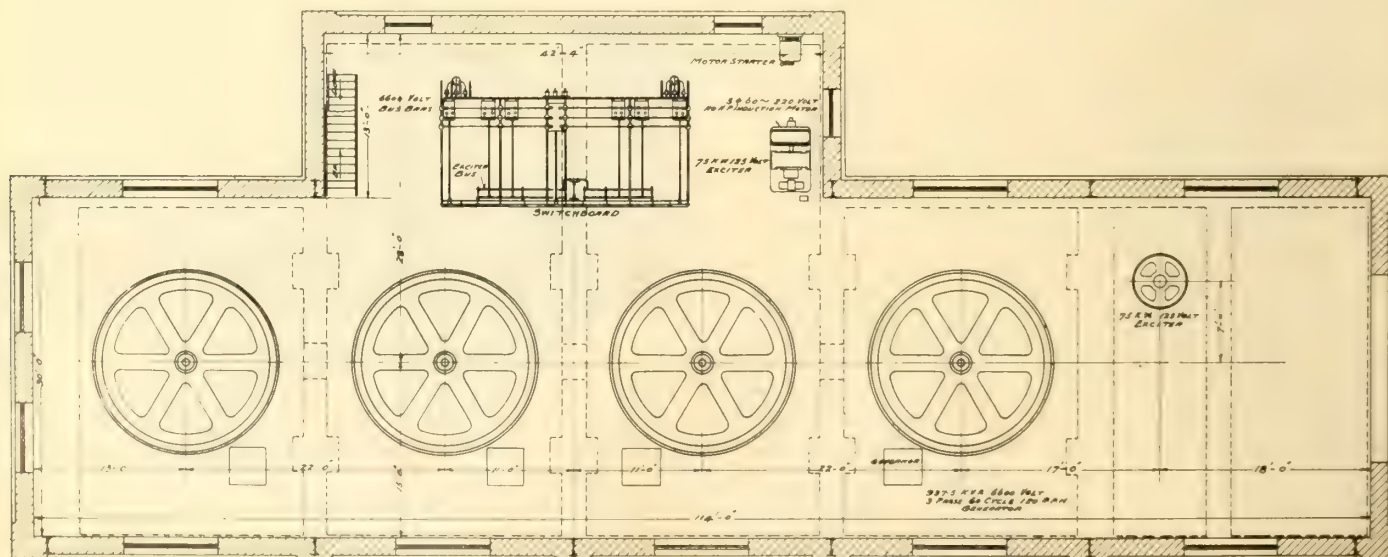


Fig 5—Power House at Dam No. 2—Ground floor, plan

bay. The normal depth is ten feet, giving a tailrace velocity at the maximum capacity of the plant, of four feet per second. The normal velocity is about three feet per second.

The racks are supported on concrete piers and are provided with a concrete platform at the top. They consist of flat steel bars $3\frac{1}{2}$ in. x $5/16$ in., bolted together in sections three feet wide, with $1\frac{1}{4}$ in. spaces between bars. The racks

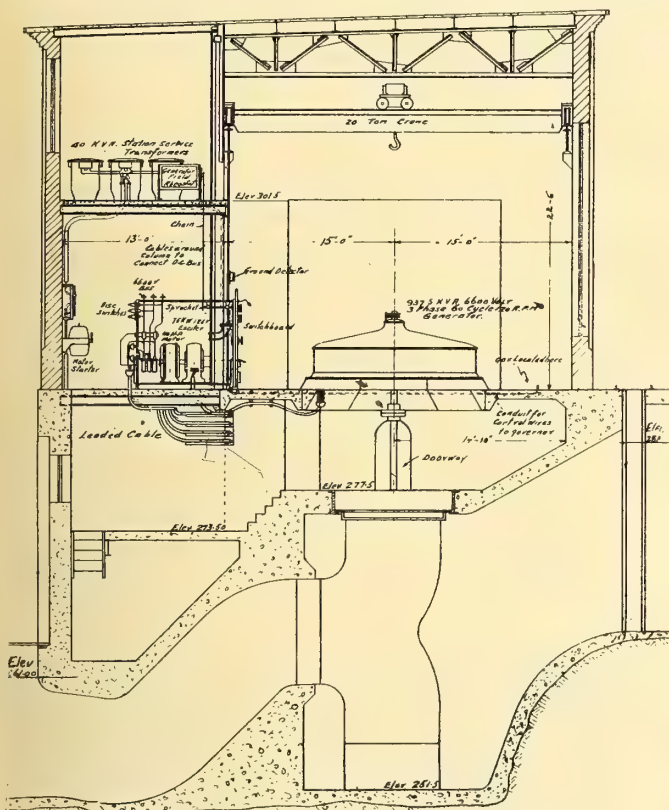


Fig. 6—Cross section plan of Powerhouse

reach to within $2\frac{1}{2}$ feet of regulated head water level. Above this point, to the top of the platform, solid wooden sections are used. With this arrangement, the surface water has no tendency to flow through the racks but passes along the front and over the first sluice in the dam, carrying with it all floating debris, etc. A good stream of water is kept flowing over this sluice except in the months of minimum flow (September and October) in order to carry off any floating material that comes down the river. The flow over the dam is regulated by stop-logs.

Travelling sluice gates are provided for the wheel pits both at the head and tailrace. These are of steel and are carried by a steel frame work which may be moved along a track over the opening in the platform. The gate at the headrace is motor operated, while that at the tailrace is hand operated since it is only used in dead water.

The turbines consist of four main units of 1,400 horse power each, running at 120 r.p.m. and of one exciter unit of 140 horse power, running at 240 r.p.m. They are of the vertical type, the main units having a double runner and the exciter unit a single runner. The weight of the rotating parts, both of turbine and generator, is carried by the thrust deck, eight feet below the main floor, with the exception of the exciter unit, in which the exciter is provided with the thrust bearing. The thrust bearing on the main unit is a special feature of this machine. A heavy cast iron clamp is bolted and keyed to the turbine shaft and the bearing plate is held to this clamp by dowels. This plate is of cast steel, ground and highly polished, and revolves on a self-aligning disk with a face of special hard

Swedish babbit. The whole is encased in a water-cooled oil bath, the cooling water being supplied either from the fore-bay or from the pressure system.

The cover above the top runner is designed to relieve the downward thrust of the water at that point. In operation, a vacuum is produced above the runner at all loads. The lower cover gives water under pressure free access to the head of the lower runner. There is thus considerable hydraulic uplift, which assists the thrust bearing materially. There is no central bearing in the turbine. The lower guide bearing is babbitted and is lubricated by oil from the station oiling system.

The governors were designed especially for this plant and combine strength, reliability and compactness. The piston rod acts directly on the vertical gate shaft without any intermediate gears. The cylinder, oil pump, oil tank, air chamber, pendulum and relay mechanism are all mounted on one base, and form a complete unit. A single belt drive, from the main shaft, operates both pendulum and pump. The pumps are of the rotary gear type. The workmanship on them is excellent and no trouble has been experienced from the combined drive. The governors are fitted with a double compensating mechanism, giving practically constant speed at all loads. Fig. 8 shows one of these governors. The turbines and governors were furnished and installed by the Canadian Boving Company.

A 20-ton travelling crane fitted with an electric hoist is provided for handling the parts of the machinery. The motor on the hoist is a three-phase, 220 volt induction motor. This crane was furnished by the Whiting Foundry Equipment Company.

The main generators are of 937.5 kv.a. capacity and are wound for 3-phase, 60 cycle, 6600 volt operation at a normal

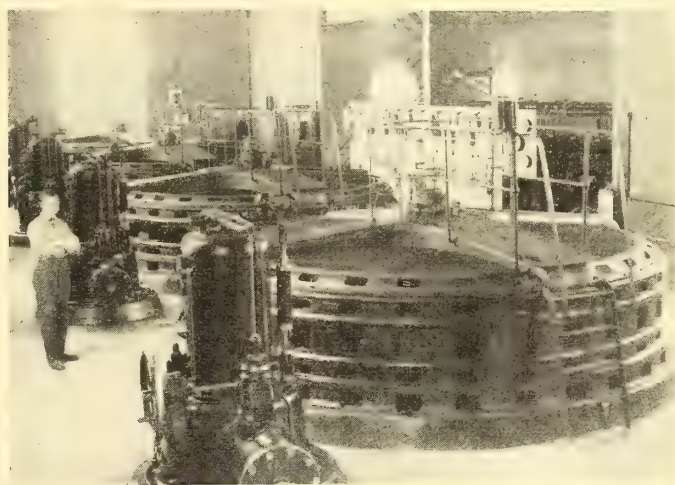


Fig. 7—General View of Interior

speed of 120 r.p.m. They will carry 25 per cent. overload continuously, and are tested to stand a runaway speed of 70 per cent. above normal for 15 minutes with full field current. Each generator is connected to its turbine by means of a split sleeve coupling and is provided with two guide bearings, the weight of the rotating part being carried by the turbine thrust bearing. These guide bearings are of babbit and are supplied with oil from the station oiling system. An auxiliary reservoir is also supplied for each generator, consisting of a large glass oil cup attached to the top of the hand-rail on the generator. The oil flows through the top guide bearing to the lower guide bearing and is caught in a drain pan and piped to the oil filter. Steps and hand-rails are provided on each generator to allow easy access to the upper guide bearing and to the slip-rings. The generators are so constructed that, by lifting off the top and

removing the rotating field, the turbine parts may be lifted up through the stator. Wire mesh screens cover the openings in the top of the generators. Fig. 7 shows the four generators and gives a good idea of the arrangement of the apparatus in the building.

Two exciters are provided, each capable of exciting all

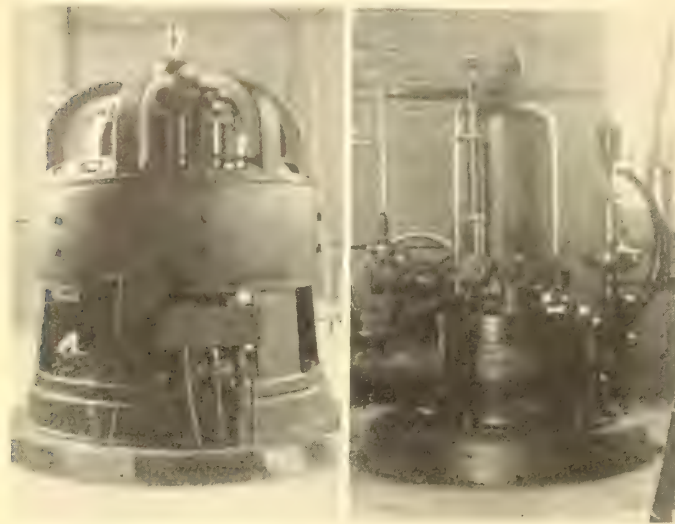


Fig. 8—75 Kw. Vertical Exciter Fig. 9—Turbine Governor

four generators under 25 per cent. overload at 65 per cent. power factor. One exciter, Fig. 8, is a vertical machine of 75 kw. capacity at 125 volts, 240 r.p.m. and is direct connected to a 140 h.p. vertical turbine. The other exciter is a motor driven machine of 75 kw. capacity at 125 volts, 690

r.p.m. direct connected to a 110 h.p., 3 phase, 60 cycle, 220 volt, 690 r.p.m. induction motor of the wound rotor type. This exciter set is located at the west end of the switchboard bay. The vertical exciter is located towards the shore end of the power house, and its turbine gates are controlled either at the exciter or by means of a shaft attached to the side wall of the power house and carried to a point near the motor generator exciter where a suitable hand wheel is provided. The equalizer switch pedestal is also located close to this hand wheel, this location being handy to the switchboard.

The switchboard, located along the front of the extension provided for it, is of white Italian marble and consists of eleven panels, and a swinging panel, the total length being 24 feet 8 inches. From the left end of the board the panels are arranged as follows: Tirrill regulator panel, outgoing line panel, two generator panels, motor driven exciter panel, station service transformer panel, local service panel, vertical exciter panel, two generator panels, outgoing line panel and the swinging panel. Fig. 10 shows the connection diagram for the main circuits while Figs. 12 and 14 show the back and front of the board.

The outgoing feeder panels are each provided with a remote controlled automatic oil switch and with one 400 ampere ammeter with a switch so that the current in any phase may be read on it. Synchronizing plug receptacles are provided on these panels in order to allow of synchronizing this station with other stations. The Tirrill regulator panels contain a TA form K-9 regulator which is so arranged that it may be connected on either outgoing line.

The generator panels are each provided with one 125 ampere a.c. ammeter, one 200 ampere d.c. field ammeter, one power factor meter and one indicating 1200 kw. wattmeter.

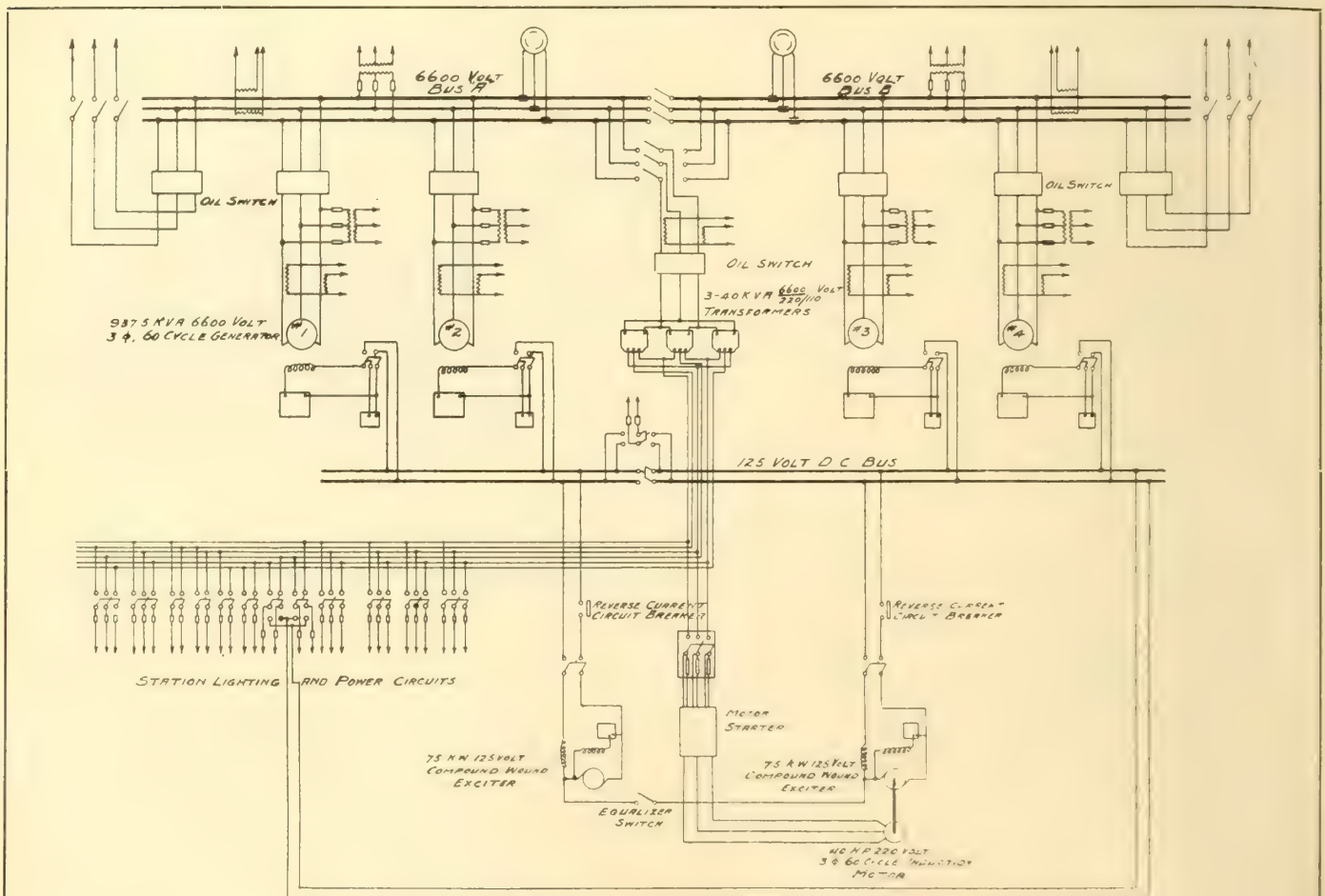


Fig. 10—Connection diagram at Power House, Dam No. 2

A field switch, ammeter switch, voltmeter and synchronizing plug receptacle, a turbine governor control switch, and a rheostat hand wheel are provided on each panel. The oil switches for the generators are of the remote-controlled non-automatic type.

Each exciter panel contains one 180 volt d.c. voltmeter and one 800 ampere d.c. ammeter, with a rheostat hand wheel and a two-pole 800 ampere main switch. On each exciter panel is installed a 600 ampere, single pole, carbon break circuit breaker with reverse current trip attachment. This is connected in on the negative side of the exciter, so as to prevent trouble when paralleling the two exciters.

The station service transformer panel controls the three 40 kv.a., single phase 6600/220/110 volt station service transformers. These are self-cooled units and are located on the gallery floor above the switchboard room. This panel contains one 20 amp. a.c. ammeter with ammeter switch, one remote controlled automatic oil switch and one two-pole, double throw knife switch to supply the control bus, which supplies direct current for the trip coils on the automatic oil switches. An 800 ampere, two-pole switch is installed on this panel and is a tie switch between the two sections of the exciter bus bars.

The local service panel contains a number of two and three pole knife switches and controls the lighting and local power circuits for the station. The swinging panel, at the right hand end of the board, contains three 7000 volt a.c. voltmeters, one for each section of the bus bars and one for the incoming generator. The first two will give the voltage on any phase of the bus bars by means of the volt-

tions by disconnecting switches. Disconnecting switches are also provided so that the station service transformer oil switch may be connected to either section. The exciter bus bars are also sectionalized and hence the station may be run in two independent halves if necessary. Static ground detectors are installed in each section of the main bus bars. These are mounted on a bracket attached to the steel column above the local service panel and hence can be easily seen from the front of the board. A station clock, mounted in an ornamental scroll work, is attached to the top of the



Fig. 11—Bus-bars, Oil-Switches, etc.

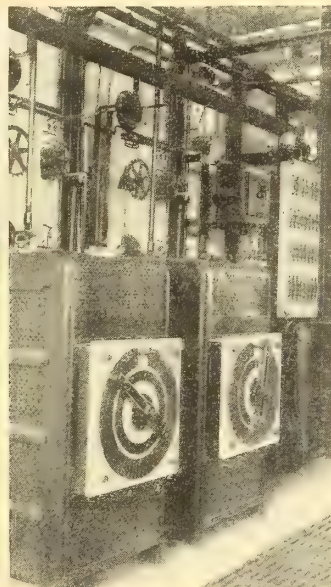


Fig. 12—Back of Switchboard

meter switch on each outgoing line panel. A frequency indicator and synchroscope are also provided on this panel, the frequency indicator being connected in parallel with the third voltmeter and connected to any generator through the voltmeter receptacle on the generator panel. A three pole, and a two pole knife switch on this panel are so arranged that the one winding of the synchroscope may be connected to the potential transformers on either section of the main bus bars and so that the other winding may be disconnected from the generator potential transformers when not in use. The synchronizing connections are such that it will indicate synchronism between any generator or outgoing line and either section of the bus bars.

The main 6600 volt bus bars are divided into two sec-

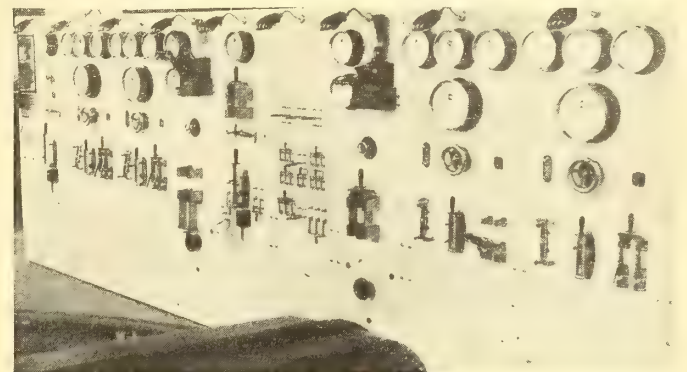
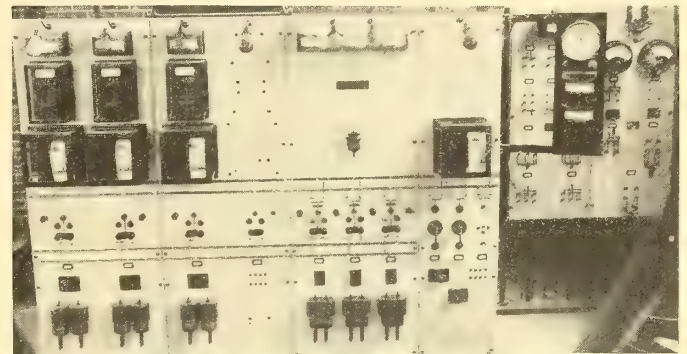


Fig. 13—(above)—Transforming Station Switchboard
Fig. 14—(below)—Generator Station Switchboard

board at the centre. Watt-hour meters are installed on each outgoing line and are mounted on the rear of the line panels. These lines are each of sufficient capacity to carry the full station output.

The oil switches, knife switches, instrument transformers and 6600 volt fuses are all mounted on an angle iron framework to the rear of all panels as shown in figure 11. The oil switches are worked by means of levers and overhead connecting rods and the instrument wiring is carried to the panels in conduit, making a very neat installation and a safe one, since no voltage higher than 125 is brought to the panels. All live parts of wiring which are not thoroughly insulated are painted a bright red, while all other material is painted black, thus making the live parts quite prominent and reducing the liability of accident. Hardwood gratings with rubber mats are provided for the floor at the front and rear of the panels and behind the bus structure, and all framework, switch tanks, cable end bells, instrument cases, generator frames, etc., are thoroughly grounded.

The connections from the generators and exciters to the switchboard are of lead covered cable. The outgoing lines are underground and run in clay ducts to the transforming station across the road. Each consists of two No. 0000 B&S triple conductor lead covered cables in parallel.

The auxiliary apparatus in the station consists of two 2-in. Watson-Stillman twin volute turbine pumps, each direct connected to a 5 h.p., 220 volt, 3 phase Wagner in-

duction motor. These pumps pump water from the forebay to the transforming station for use in the cooling coils of the transformers. An air compressor outfit consisting of a 4½ in. x 6 in. Rand compressor belted to a 3 h.p., 220 volt Westinghouse induction motor supplies compressed air to various outlets around the building and also to the transforming station, for cleaning purposes. This motor may also be belted to an overhead shaft driving an emery wheel and a drill for use in making minor small repairs.

A gravity oiling system has been installed, consisting of pressure, storage and settling tanks, with filter, and with piping to all turbines, generators and governors. The oil passes through the filter before being pumped to the pressure tank, from which it runs to the various units. After being used, it is returned to the storage tanks and is passed through the filter again. After some months use, it is allowed to stand in the settling tanks for a time. Most of the impurities are there removed, and the oil may be re-filtered and used again.

The lighting system at this station is arranged for alter-

transforming station located just across the road. This station is designed also to receive the output of the generators at Dam No. 1 and Dam No. 5. The building is so constructed that it may easily be extended, if necessary, to provide for additional circuits at either 6600 volts or 44000 volts. This station, a section of which is shown in Fig. 15, is a brick building 61 ft. 3 ins. by 56 ft. 6 ins. and 45 ft. high. Provision is made in the present building for three 44000 volt lines and for eight 6600 volt lines, two of which are underground. A double high and low tension bus bar system is installed in order to give a flexible switching arrangement. Provision is made for three 3000 kv.a. transformers, two of which are now in service, the third being used temporarily elsewhere. These transformers are 3 phase, 60 cycle water cooled units, arranged for 44000 volts on high tension side with 42000, 40000, 38000 volt taps, and for 6600 volts on the low tension side. The tanks are of boiler steel, with a vent in the cover to relieve pressure inside the tank. An oil gauge and thermometer are provided at the top of the tank and a 4-in. valve at the bottom for draining off the

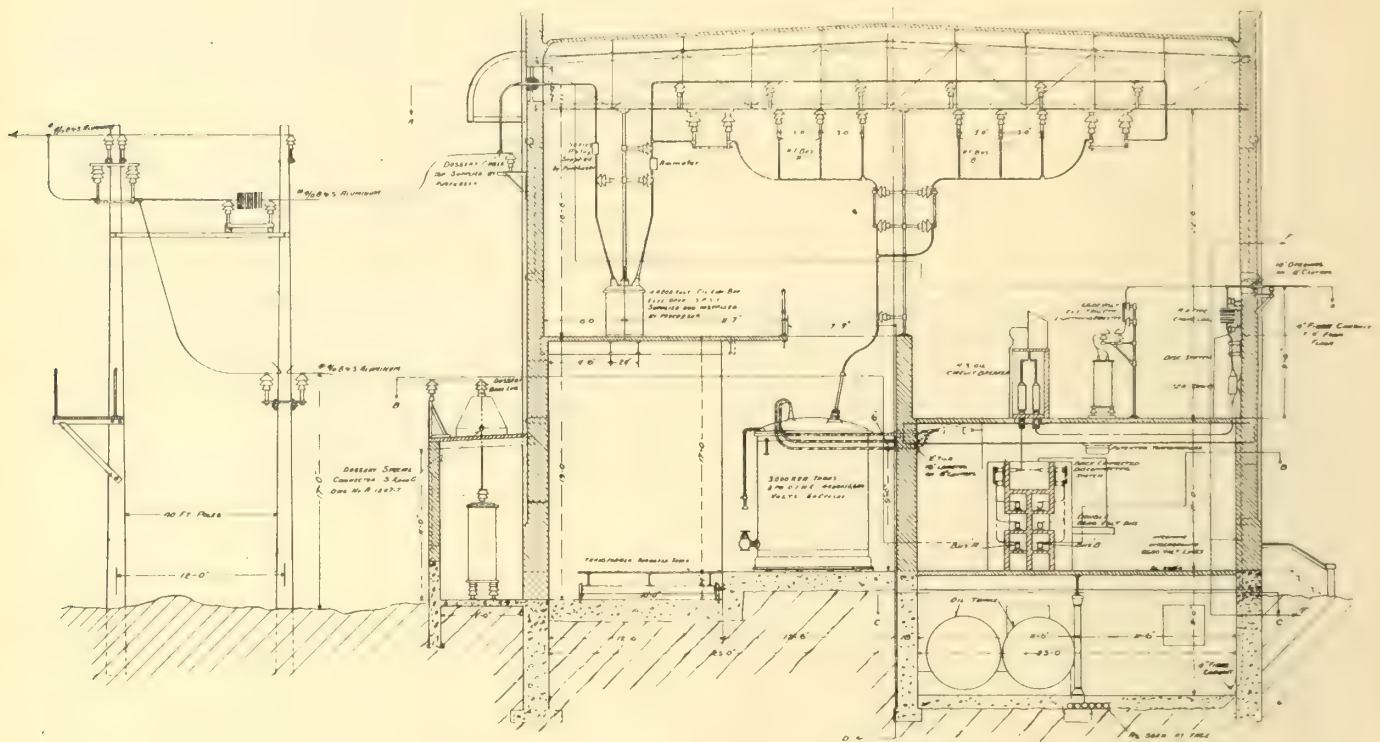


Fig. 15—Cross Section of Transforming Station

nating current but some circuits are provided with double throw switches so that they may be connected to the exciter bus bars. Tungsten cluster fixtures with four 100 watt lamps are used for the general lighting of the main floor and for head race and tail race lighting with individual tungsten lamps at various points about the building. The switchboard is lighted by a bracket fixture with shade at the top of each panel.

A gong signal system is installed in the building, with gongs on the thrust deck, and at the head race and tail race. These are controlled by a push button at the switchboard and operate at 110 volts a.c. from the service transformers. They enable the switchboard attendant to signal his assistants from any point in the power house to the switchboard.

The generators, exciters, station service transformers switchboard and switching equipment for this station were manufactured by the General Electric Co. of Sweden and were supplied and installed by Messrs. Kilmer, Pullen & Burnham of Toronto.

The entire output of this station is delivered to the

oil. A small pet-cock is also provided at the bottom of the tank for draining off samples of the oil.

These transformers have wheels provided in the base and are set on rails laid in the floor. They are installed in separate pockets with a passageway in front, provided with rails and a truck so that the transformers may be shifted to the spare pocket near the door under the 20-ton chain hoist. The transformers were supplied and installed by the Canadian Westinghouse Co.

Above this passage way is a floor which supports the 44000 volt circuit breakers. These are Westinghouse, type G.A. breakers and are electrically operated. They are also arranged for hand operation for emergencies. Series inverse time limit overload relays make these breakers automatic in operation.

The back wall of the transformer pockets forms a division wall for the building, and on the other side there is a basement and two floors. The basement contains two large oil tanks, 5 ft. in diameter by 19½ ft. long, the storage battery room, the heating furnace and lavatory, also space for storing miscellaneous material. An outside and inside

stairway provide access to the basement. The second floor contains the 6600 volt bus structure, while the floor above contains the 6600 volt oil switch structure and the incoming lines and the switchboard, telephones, etc. A stairway from this floor permits access to the 44000 volt oil switch floor. The 44000 volt wiring and bus bars are attached to the steel roof trusses by suitable insulators.

The main switchboard, Fig. 13, consists of four panels of blue Vermont marble and has a mimic bus bar mounted on it showing the station wiring scheme. Red and green lamps show whether the oil switches are closed or open and small switches are provided in the mimic bus to show the position of the disconnecting switches in the station. The first panel contains the instruments and control switches for the underground incoming lines from the power house across the road at Dam No. 2. The second panel is similar to the first and contains the equipment for one of the two overhead lines from Dam No. 1 power house. The equipment for the second line is now being added to this panel. The third panel controls the three 3000 kv.a. transformers and the fourth panel controls the three 44000 volt outgoing lines, only two of which are yet installed. A fifth panel, similar to the first, is now being added to the left end of the board to take care of the two incoming overhead lines from Dam No. 5. Each 6600 volt line panel controls two lines, the equipment for each line consisting of one 400 ampere ammeter with ammeter switch, one polyphase watt-hour meter, one graphic recording 4500 kw. wattmeter, one pull button control switch with indicating lamps, one synchronizing plug receptacle, one 8-point voltmeter plug receptacle and one inverse time limit overload reverse current relay. The transformer panel contains, for each transformer, one 400 ampere ammeter, one pull button control switch with lamps, one inverse time limit overload relay, one synchronizing and one 4-point voltmeter plug receptacle. This panel also contains a bell alarm relay which operates a bell when any of the oil switches open automatically. The 44000 volt line panel controls three lines, the equipment for each consisting of one drum type control switch and lamps. It also contains a graphic recording voltmeter with a 6-point plug switch so arranged that the meter may be connected to potential transformers on either of the 6600 volt bus bars. Two 8-point plug receptacles are also provided on this panel to indicate the phase voltages of the 6600 volt bus bars on the two indicating voltmeters on the swinging panel. This swinging panel also contains a synchroscope, provided for switching purposes to show whether a line is in synchronism with the bus bars. A clock is mounted over the switchboard in a prominent position.

The auxiliary switchboard consists of two small panels of blue Vermont marble, the first panel containing the knife switches for the lighting and local power circuits around the building while the second panel controls the storage battery and the control bus. The lighting circuits are 110 volt circuits supplied from the three 40 kv.a. transformers in the power house across the road. The power circuits are 3 phase, 220 volt circuits also supplied from the same transformers. The storage battery panel receives its charging current from the exciter bus bars in the power house. Some of the lighting circuits are arranged to be thrown on the storage battery in case the a.c. supply should fail.

The incoming 6600 volt lines are provided with aluminum cell lightning arresters. The circuits from the line inlets pass down under the switch room floor to the H-3 oil switches, thence through disconnecting switches to either of the 6600 volt bus bars. The transformers are connected in a somewhat similar manner to these bus bars. The 44000 volt leads pass up from the transformers through an opening in the floor above the pocket, and are connected, through disconnecting switches, to either of the 44000 volt bus bars

attached to the bottom of the roof trusses. The outgoing lines may be connected to either of the 44000 volt bus bars through downward pull disconnecting switches. Each phase of each 44000 volt line is provided with a 100 ampere ammeter mounted on an insulator and connected directly in the circuit between the oil switch and the bus bars. After passing through the oil switches and series relays, the 44000 volt wires pass out of the building through wall bushings and are connected to the transmission lines on a concrete pole structure to the south of the building as shown in the photograph in Fig. 16. The line disconnecting switches and choke coils are mounted on this structure, also the arrester horn-gap switches. The lightning arrester leads tap off the line conductors between the choke coils and disconnecting switches, drop down to the horn gap switches, and then connect to the roof inlet bushings in an annex to the main building. This annex contains three separate compartments for the 44000 volt aluminum cell lightning arresters. Each compartment is provided with a door opening into the passage way in front of the transformers.

A complete oil piping system is installed to handle the oil to and from the transformers, and is so arranged that the oil from any transformer may be discharged through the 4 inch valve into either of the two tanks in the basement. From either of these tanks, the oil may be discharged into the drain or else pumped through a filter and dryer into the other tank or back to the transformers. Cooling water for the transformers is supplied by pumps located in the basement of the power house. A twin strainer is installed in the main pipe to the transformers. The water from the transformers is discharged into the drain. Compressed air is also piped to this building from the compressor in the power house.

All the switchboards and switching equipment in this building were supplied and installed by the Canadian General Electric Co. with the exception of the 44000 volt oil switches which were furnished by the Canadian Westinghouse Co.

About 4 miles further up the river is Dam No. 5 where at the present time a power house is under construction. This

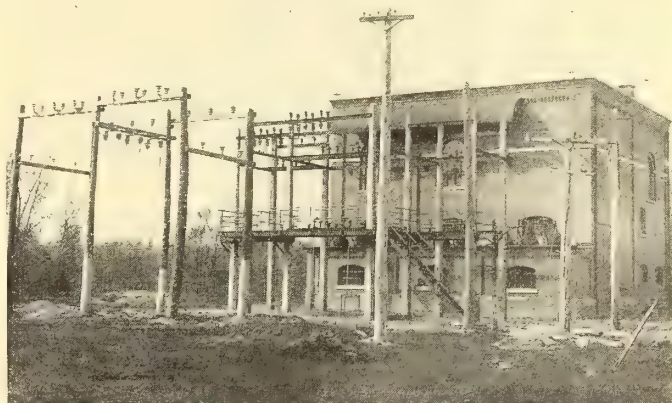


Fig. 16—44,000 v. transmission lines and concrete pole structure

station will deliver its entire output to the transforming station over a double circuit 6600 volt transmission line. The building is situated just below the west end of the dam and is arranged somewhat differently to that at Dam No. 2.

The building is to be of red pressed brick with a reinforced concrete substructure and is 30 feet wide by 147 feet 8 inches long, inside dimensions. The switchboard and switching equipment are all placed on a raised floor at one

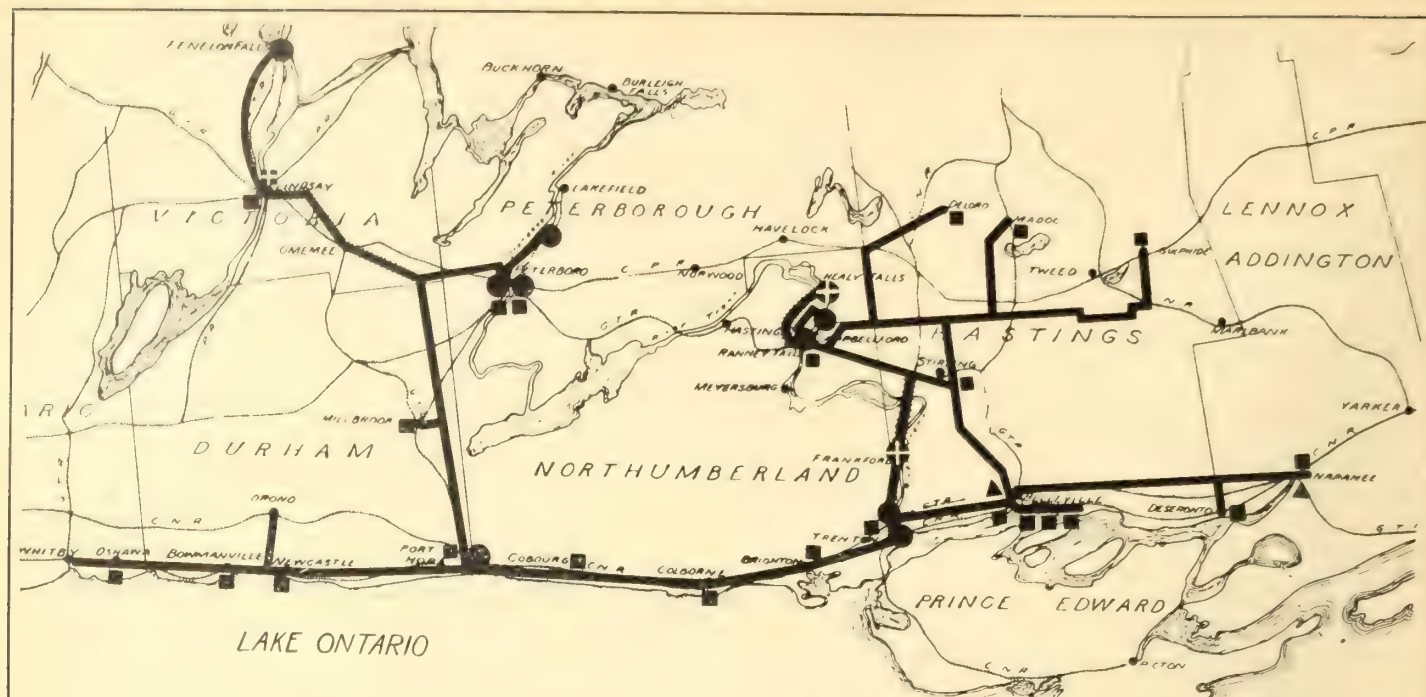


Fig. 25—Map of Electric Power Co.'s System

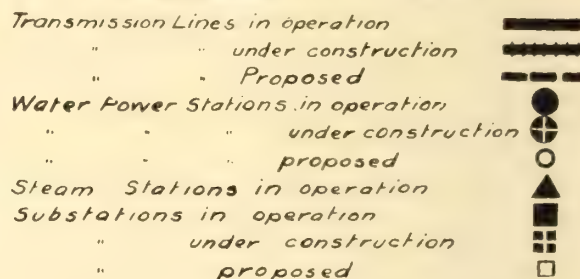
end of the building, with an erecting bay immediately in front on the main floor. The exciter bay and four generator bays complete the building.

The front of the building is parallel to the dam and some distance behind it. The water enters the forebay through the three west sluice sections of the dam and passes through the racks to the vertical turbines, thence to the tail race and to the river, the head being 18 feet. The racks are of steel similar to those at Dam No. 2 power house, but in this case are set at right angles to the flow of the river. A spillway is provided in the east concrete wall of the forebay to carry away ice, etc., from the front of the racks.

The turbine equipment consists of four main 1200 h.p. 112½ r.p.m. vertical double runner turbines similar to those at Dam No. 2 power house. These are being supplied and installed by the Canadian Boving Co. The exciter turbine is of 140 h.p. capacity at 225 r.p.m. and is of the single runner vertical type. It is being furnished and erected by the Wm. Hamilton Manufacturing Co. of Peterboro.

The main generators are of 812.5 kv.a. capacity, wound for 3 phase, 60 cycle, 7000 volt operation at 112½ r.p.m. The turbine driven exciter is a vertical unit of 75 kw. capacity, 125 volts at 225 r.p.m. A motor driven exciter is also being supplied consisting of a 75 kw. 125 volt exciter direct connected to a 110 h.p., 3-phase, 2400 volt, 800 r.p.m. induction motor of the wound rotor type. This set will be supplied through a bank of step-down transformers consisting of three 75 kv.a. 6600/2400 volt, 60 cycle, single phase self-cooled units. The generators and exciters are being furnished by Messrs. Kilmer, Pullen & Burnham, and the Canadian General Electric Co. are supplying the transformers.

The switchboard at this power house consists of 12 panels of black slate with one swinging panel, making a total length of 23 feet. The mechanical arrangement of the switches, bus bars, etc., is similar to that at Dam No. 2, but the electrical arrangement is much different, since the station is not arranged to be divided into two independent halves. There is one set of 7000 volt bus bars to which are connected the four generators. Two outgoing lines are connected to one end of this bus and provision is made for extending it. To the other end there is connected the bank of 75 kv.a. transformers, which supply a short 2400 volt bus



bar, to which is connected the motor of the motor-generator exciter set and a bank of three 7½ kw. service transformers for station lighting and power service. This bus bar is so arranged that it may be extended if 2400 volt local feeders are required in the future.

Starting at the left hand end of the switchboard, the panels are arranged as follows: swinging panel with bus bar instruments, turbine driven exciter panel, motor driven exciter panel, Tirrill regulator panel, two blank panels for future 2400 volt feeders, motor panel, four generator panels, and two outgoing 7000 volt line panels. The equipment on the various panels is practically the same as on the panels of Dam No. 2 power house switchboard. An auxiliary panel to control the station lighting and power circuits is installed at the rear of the main panels.

The oil switches, disconnecting switches, instrument transformers and bus bars will be installed on an angle-iron framework behind the main panels, with a passage way in front and at the back of the framework structure. The switchboard instruments are all of Weston manufacture and are being supplied and installed by the Monarch Electric Co. of Montreal, who are building the switchboard and who will install all the switching equipment in this station.

The three 75 kv.a. transformers will be located at one end of the switchboard room. On the gallery floor above, will be located the aluminum cell lightning arresters for the two outgoing lines, also an office and space for store room. In a basement under the switchboard room, an air compressor, furnace and work bench will be installed.

Lighting, oil piping, air piping and gong signal systems will be installed similar to those at Dam No. 2. A 20 ton travelling crane will span the building. This is

fitted with an electric hoist and is being supplied by the Advance Machine Works Co.

The construction work on this station is proceeding rapidly and it is expected that it will be in operation within the next few weeks.

The transmission line from this power house to the transforming station consists of a single pole line carrying four circuits, each consisting of three 300000 c.m. aluminum cables. These are carried on three four-pin cross-arms and are supported on porcelain insulators (Ohio Brass No. 10044) with 24 inch spacing, centre to centre of conductors. A $\frac{3}{4}$ inch galvanized steel ground wire is carried at the top of the pole on a pressed steel support bolted to the pole with through bolts. A telephone circuit of No. 9 B.W.G. galvanized iron wire is carried on a two-pin arm, three feet below the lowest cross-arm of the power circuits. Thirty-five foot poles are used spaced 100 feet apart. The four circuits on this line are connected two in parallel so as to form two separate feeders.

The two feeders from Dam No. 2 power house to the transforming station each consist of two No. 0000 B&S triple conductor paper insulated lead-covered cables in parallel installed in clay ducts.

The feeders from Dam No. 1 power house will consist of two circuits of No. 0000 B&S aluminum cable on a single pole line. One circuit is already installed and is in use to supply power to Trenton at present. These circuits are carried on two four-pin cross-arms on porcelain insulators (Locke No. 63) with 16 inch spacing from conductor to conductor. A telephone line and overhead ground wire is carried on the same poles.

One 44000 volt transmission line extends east from the transforming station, crossing the river just below the power house at Dam No. 2. This line connects to the switching station north of Belleville, there connecting to a line from the Seymour Power & Electric Company's power house at Campbellford. Another line extends west from this same station supplying Brighton, Colborne and Cobourg and connecting, at the Port Hope switching station, with a line from the Auburn Power Company's power house at Peterboro. A future third line will run north from the transforming station to also connect in with a line from Campbellford.

It will be seen from the above that this transforming station is one of the most important stations on the Electric Power Company's system since it will eventually deliver the output of four power houses to the 44000 volt transmission lines. It also provides for a supply of power for Trenton from various sources. This is a very important consideration on account of the promising load in and around Trenton.

A map of the lines of the Electric Power Co. is shown, which indicates the relation of the numerous developments in the Trenton district to those in the other power house districts at Campbellford, Peterboro, and Lindsay. It also shows the large number of towns and cities served by the lines of the Electric Power Company and indicates the high factor of safety assured for rendering continuous service to every point in the districts covered.

The work of construction of the power houses at Dams No. 2 and No. 5 and of the transforming station at Dam No. 2 was carried out by the Midland Construction Co. (the sub-contractors being Larkin & Sangster, F. R. Wilford and Wells & Gray), according to the designs and under the supervision of Messrs. Smith, Kerry & Chace, consulting and operating engineers for the Electric Power Company.

Personal

Mr. S. D. Egan has been appointed superintendent of the Regina Municipal Street Railway System.

Mr. J. B. Rannie has been appointed traffic agent in charge of the B.C.E.R. city and suburban lines.

Mr. E. A. Robert, president of the Montreal Street Railway Company, has been unanimously chosen by the Liberals of the county of Beauharnois as their candidate at the next election.

Mr. K. L. Aitken, managing engineer of the Toronto electric distribution plant, is taking a six months' holiday. Mr. W. R. Sweany, business manager of the system, will be acting managing engineer in Mr. Aitken's absence.

Mr. W. C. Burch for the last two and a half years assistant chief purchasing agent for the Toronto Hydro-electric system has been appointed chief purchasing agent. Mr. Burch was for a number of years with the N.S. & T. Railway Company.

Mr. E. Richards, chief of the purchasing department of the Toronto Hydro-electric System, has resigned and accepted a position in the Department of Customs at Ottawa as Dominion appraiser, where he will have special oversight of machinery entering Canada from foreign countries, including all electrical equipment. Mr. Richards is a graduate of the applied science department of the University of Toronto, graduating with the degree of B.A.Sc. in 1900. Following graduation he was with the Toronto Electric Light Company for five years and later was chief assistant to Mr. Cecil B. Smith, who at that time was chief engineer for the Hydro-electric Power Commission of Ontario. In 1908 he transferred to the city hydro-electric service, where he has remained up to the present time. Mr. Richards has always been prominent in electrical society work and has taken, especially, a deep interest in his alma mater societies and in the Toronto branch of the American Institute of Electrical Engineers. He was chairman of the latter during the sessions of 1910-1911 and president of the Toronto Alumni branch of the faculty of applied science of the University of Toronto in 1909-1910. Mr. Richards assumes his new duties with the first of the present month. On the eve of his departure, as indicating the high esteem in which he was held, he was presented by his colleagues with a handsome travelling bag.

G. V. Electrics

"Modern Motor Delivery with G. V. Electrics," is the title of an attractive illustrated bulletin just issued by the General Vehicle Company, of Long Island City, N.Y. This



company is building up a good business in Canada, among their recent sales being two $3\frac{1}{2}$ ton trucks to the Eugene O'Keefe Brewing Company, Toronto, and one to the Eugene Phillips Electric Company, Montreal.

The Tendency Towards Larger Turbines

The 18,000 h.p. Units of the Pacific Coast Power Co.— Develop in Service up to 20,800 h.p.—A. C. Manufacture

The recent announcement by the Rio Janeiro Tram, Light & Power Company of the placing of an order for Swiss turbines to develop, under normal conditions, a capacity of 20,000 horse power, indicates that in point of size, the South American company will establish a new record.

The largest hydraulic turbines in North America are installed in connection with the White River hydro-electric development of the Pacific Coast Power Co., of Seattle. Each turbine here is designed to develop 18,000 B.h.p. at 360 r.p.m. under 440 effective head. Each is capable of developing 20,400 B.h.p. with a maximum head of 480 feet and at the same speed. All parts of the turbine are designed to withstand the maximum pressure of 480 ft. and the runaway speed of the rotors under this head brings no undue stresses. These turbines now carry 20,800 h.p. in service under the lower normal head. The next nearest approach in size seems to be the 18,000 h.p. 525 ft. head turbines of the Great Western Power Co., at Oroville, Cal. The White River turbines, described below, were manufactured and installed by the Allis-Chalmers Co., of Milwaukee.

The diagrams shown in figures 1, 2 and 3 have reference to the White River turbines. These are of the inward-flow reaction type commonly called the "high-head Francis." At the wish of the purchaser a spiral case, double discharge arrangement was adopted. The operating water enters the spiral casing from below and passes around this and out through the speed ring. Immediately upon entering the runners it is divided along two paths with separate quarter turns and steel-plate draft tubes.

To facilitate the erection and to enable complete assembling at the shop, the turbine was designed entirely self-contained. All the main elements are mounted upon a base plate which, once leveled on the foundation and properly grouted in place, forms a reliable base for the whole machine. The spiral casing is of cast steel, made to withstand a test pressure of 385 lb. per sq. in.; it was annealed to increase its resistance against the positive and negative pressure variations, which may occur in exceptional cases of severe load changes. This casing is split in a horizontal plane through the center line of the shaft. The figure shows that opposite the inlet-pipe connection there is an outlet branch for connecting the relief-valve pressure regulators.

To reduce the stress in the casting, which would result if the inner ring of the casting were entirely open, a skeleton speed ring of annealed cast steel is bolted over this inner opening, and its substantial webs form a solid cross-connection without obstructing the radial flow of water. The two inner flanges of the same speed ring carry the speed-gate covers, which in turn are bolted to the quarter turn discharge pipe and are also bored out to receive the several bronze bushings, which form the bearings for the pivoted guide vanes. Inner radial faces of the speed-gate covers are lined with removable facing rings to take the grinding wear expected from the presence of glacial silt in the White River.

High velocities are allowable in spiral cases under high head, but all obstructions to free water passage have to be avoided and all friction contacts have to be kept outside of the casing for ready inspection and easy lubrication; in this case, therefore, the so called "outside" gate rigging was adopted. The guide vanes (speed gates) and pivots are forged in one piece, the pivots projecting on either side

through bronze-bushed bearings and large packing boxes to the outside of the speed-gate covers. The guide-vane pivots, on the side opposite the generator, carry levers which are connected to a shifting ring by individual links and steel pins. This ring moves in bronze ways bolted to the speed-ring flange. The shifting ring is a single annealed-steel casting with two lugs for the pins of the governor connecting rods. Each rod is operated by a bell crank and these are rigidly inter-connected by a horizontal rod underneath the shaft and directly connected to the main control lever and piston, as shown in the figures. The maximum force produced by the governor oil pressure upon the regulating piston is 50,000 lb., and all connections, including the shifting ring, are made strong enough to withstand this pressure.

If the guide-vane pivots were directly connected to the shifting ring, and any foreign matter should locate between two guide vanes to prevent closing them, then the governor would concentrate full force upon these two guide vanes and their pivots and levers which would be damaged unless of dimensions that would seriously interfere with the proper design of the guide-vane body and increase the friction of the whole gate rigging. Therefore, the stems and levers are proportioned to resist only the forces of normal operation; the connecting links between shifting ring and guide vane levers have been made to break at predetermined overload. The guide vanes tend to close to a no-load normal-speed opening, so that two broken links will not materially affect the runner speed. The levers are easily removed, and the two links may be exchanged without shutting down.

The runner is a solid steel casting, machined all over, carefully balanced and the water passages made to template. The runner is bolted to a flange of the shaft and machined

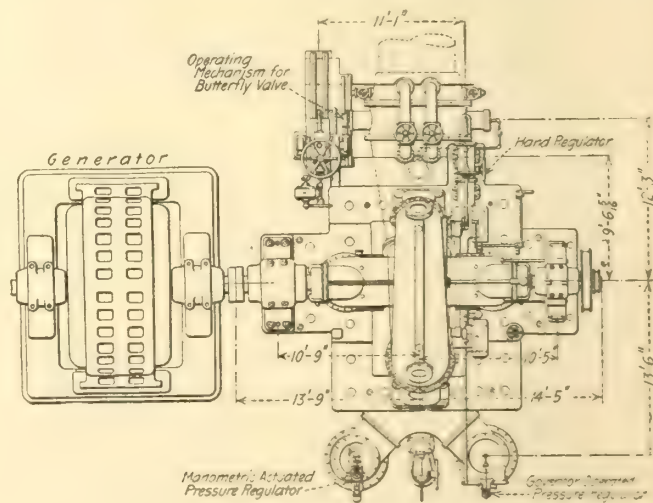


Fig. 1—Horizontal Section White River Turbines

cover rings form a smooth guide for the discharge from the runner passages to the quarter turns. The shaft is an openhearth-steel forging and rests in two ball-and-socket bearings. It has a diameter of 16 in. in the bearing at the generator end, and this is increased to 32½ in. at the center flange. The outer bearing serves as a thrust and steady bearing, with three collars forged with the shaft. Both bearings have babbit-lined shells and oiling rings dipping into large reservoirs in the pedestals.

The shaft packing boxes are of interest, for with a diameter of $16\frac{1}{2}$ in. at the quarter turns, the use of hemp is prohibited. A water-seal box has been used, operating automatically either at over pressure in the quarter turn or under vacuum. Disks on the shaft revolve in chambers connected to either circulating-water lines or drain pipes from the draft tubes.

Balancing in normal operation is relatively easily accomplished here with double-discharge runners. The speed-gate covers also from pockets between the covers and the runner walls, so that the mechanical bearing has to support only the unbalanced pressure across the quarter-turn opening in case one side of the discharge is blocked.

The base plate of the turbine forms a top for the draft tube, which is bolted on and concreted into the foundation to form a tapered elbow of long curvature.

The turbine shaft carries a friction-brake pulley, the hand-operated grips for which are mounted on an extension of the foundation base plate. This brake is designed to bring the rotor from full speed to a dead stop in five minutes, with the speed-gates closed and the spiral casing under full pressure. The brake is water cooled.

Butterfly Valves

Each turbine has its own independent pipe line, running from the forebay where are located motor-operated gate valves, so that gate valves for each turbine are not needed in the power house. However, for a quick closing of the water supply in case of accident it was found desirable to

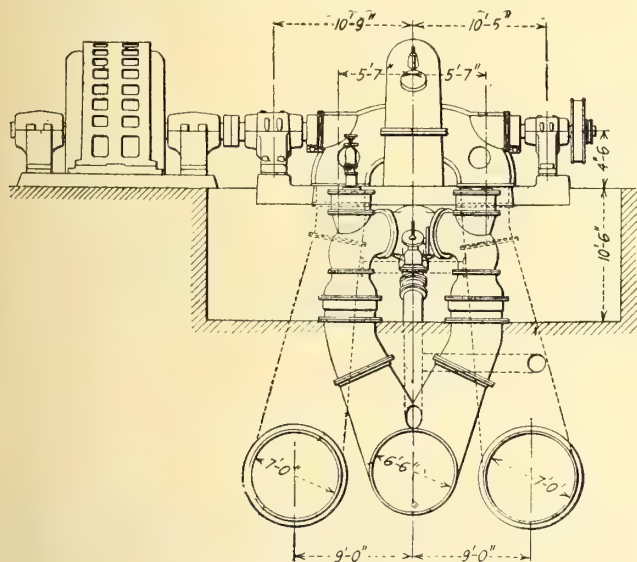


Fig. 2—Vertical Axial Section

have some means of shutting off water from the turbines quickly. For such a purpose, a butterfly valve is satisfactory, provided it can be designed to be sufficiently tight to enable inspection of the interior of the entire turbine.

A cast-steel butterfly valve of 84-in. free-passage diameter has been placed below the main floor and connected between the tapered inlet pipe and the spiral casing. Since the valve is to serve as an emergency means of shutting off water from the turbine casing, it has been built to withstand full head and it can be closed or opened under full pressure. The gate has carried a total load of over 2,000,000 lb. at 385-lb. per sq. in. test pressure. The gate can be hand-operated or worked by a direct-current motor controlled at the turbine or from the switchboard. A bypass valve may be opened for filling the turbine casing, after the valve has been closed, to balance this gate. After balancing, the valve can be opened quickly by high-speed gearing of the motor.

Governing Devices

The governor adopted here is a type with the familiar flyball lift of a floating lever carrying the regulating-valve stem compensating relay and a motor attachment for switch-board control. The governor regulating valve is double acting and hydraulically balanced so that practically no energy is required to raise or lower the valve stem. The fly balls are extremely sensitive but still release considerable energy so that the smallest speed variation will move the control valve. A speed variation of $1/5$ of 1 per cent. is sufficient to cause a motion of the turbine gates. The regulating valve is returned to its middle position after each movement of

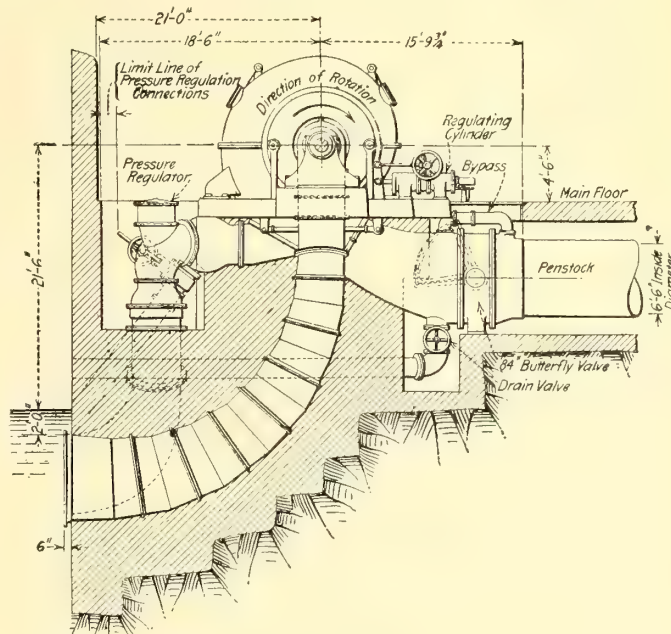


Fig. 3—Vertical Transverse Section

the compensating relay acting on the other end of the floating lever.

The desired maximum speed difference between friction load and full load can be set for any point between 0 and 4 per cent. The former, however, is not permissible with alternating-current generators running in parallel with each other, as the lack of speed variation would cause a hunting of the load between the inter-connected generators. To limit the maximum gate opening of turbines when regulated automatically, the governor control-valve stem is prevented from dropping below a certain fixed but adjustable position.

Canadian National Exhibition

The Prize List of the Canadian National Exhibition, Toronto, August 24th to September 9th, has been issued, showing the usual liberal prizes in all departments of live stock, agriculture and home work, amounting to a total of \$55,000. The list has been carefully revised to have it in keeping with up-to-date conditions.

A few of the innovations noticed are provision for competition in breeding horses for strings of five horses; a number of sections added to provide for the newer breeds of poultry; \$100 in prizes for onions, tomatoes and celery in baskets. The last named is a government suggestion meant to encourage export of these commodities.

On the whole, the list shows a distinct advance on its predecessors, and, as the attractions will include a review of cadets from all the overseas dominions of the Empire, the Scots Guards Band and a brilliant historical spectacle, the Siege of Delhi, it is safe to predict another record year for the Canadian National.

The Great Dam at Lake Coquitlam

Designed to Store 175,600 acre feet—Section is 660 feet wide at the base and 90 feet high Will flood 1,000 acres—Operations now active

The principal hydro-electric generating station of the British Columbia Electric Railway Company, Limited, is located on the North Arm of Burrard Inlet, sixteen miles from Vancouver. Here water is delivered at a head of 400 feet from Lake Buntzen, a body of water about 500 acres in extent and having a drainage area of seven square miles. The supply from this lake alone is not sufficient for the company's needs and to overcome this condition additional water is brought from Lake Coquitlam through a hydraulic tunnel 12,750 feet in length which pierces a mountain of solid granite, 4,000 feet in height. In a recent number of the Electrical News a description was given of work recently completed on this tunnel whereby it was enlarged from its original size of 9 by 9 feet to its present cross section of 192 square feet. Mention was then made that the provision of the enlarged tunnel was made in view of the company's operations in connection with the increasing of the storage supply at Lake Coquitlam and in this article an effort will be made to describe the great dam on which the company has been working for several years to accomplish that end.

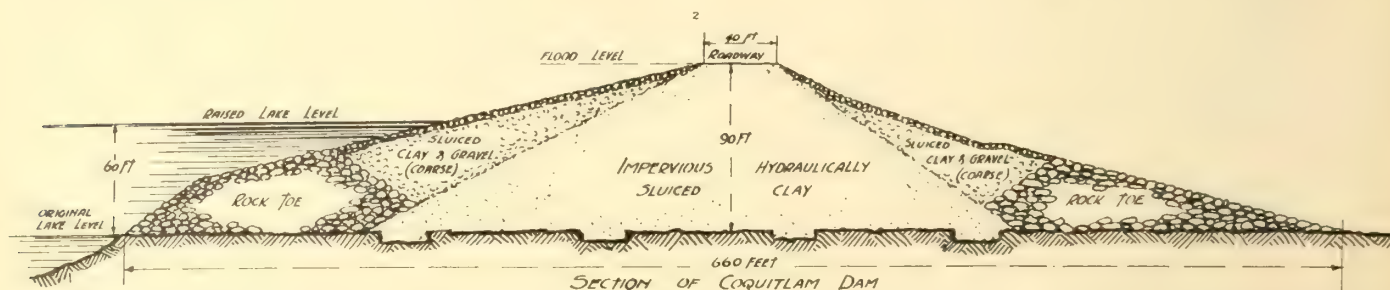
Lake Coquitlam lies directly east of Lake Buntzen, being separated only by the great mountain through which the hydraulic tunnel is driven. It is about seven miles in

This would result in increasing the storage of the lake by 162,000 acre feet and give an available supply, when the reservoir is full of about 175,600 acre feet or 7,562,000,000 cubic feet.

After a complete study of local conditions by various engineers it was decided that it was impracticable to build a masonry dam at the desired point owing to the difficulty of finding the bedrock foundation necessary to support a dam of this type and of as great a height as was proposed. On considering the question from every point of view it was decided to construct a hydraulic earth fill dam on the recommendation of Mr. J. D. Schuyler, M. Am. Soc. C. E., who acted as consulting engineer on the project until all the original plans for the dam had been prepared.

The location of the dam is at a point where a great natural dam had been formed across the valley by a receding glacier. This left on the ground any desired quantity of the very materials required for the earth fill type of dam, the original natural dam being composed of fine blue glacial clay and tightly cemented gravel and boulders.

The elevation of the crest of the dam is 518 feet, and at this point it has a width of 40 feet and a length of 850 feet. On the upstream side the slope is five to one from the crest to elevation 467 and from this point to the toe



length and has an average width of 2,500 feet, its approximate area being 2,330 acres and its watershed about 105 square miles. The lake is well located for the purpose of a source of water supply for a hydro-electric plant as the precipitation over the watershed averages 156 inches annually. The streams flowing into the lake have their original source in the high mountains surrounding the body of water where the winter snows are very heavy, remaining in the clefts of the higher peaks until late in the summer. The average runoff is nearly 1,000 cubic feet per second, the coefficient of runoff being from 75 to 80 per cent.

The natural level of Lake Coquitlam is at an elevation of 432 feet. When the B. C. E. R. Co. developed the North Arm generating plant in 1904 a rock filled timber crib dam was thrown across the outlet which raised this elevation to 443 ft. As the need of the company for an increased supply of power with which to generate current for the territory of 1,600 square miles on the British Columbia mainland which it covers with its service developed through the amazingly rapid increase of settlement and wonderful advance of population and every form of industrial activity, its engineers set to work to devise plans for increasing the storage capacity of the lake and conserving a supply which was then flowing down the Coquitlam River to join the Fraser River. After careful consideration it was decided to build a great dam just below the existing timber crib dam which would raise the level of the lake by sixty feet.

the slope is $1\frac{1}{2}$ to 1. On the down stream side the slope is 2 to 1 from the crest to elevation 500, 3 to 1 from this point to elevation 475 and from a berme, 6 ft. in width, at this point to the toe the slope is 4 to 1. At the toes of the dam on either side there are heavy rock walls which will hold the material sluiced into the dam. Both slopes are covered with riprap of a thickness of 3 feet, this being laid in concrete on the upstream side as far as the normal water level line. No care wall of any kind is provided, water-tightness being secured by the great thickness of puddle keyed into several shallow trenches, the dam being almost entirely built on tight blue glacial clay which is quite impervious and forms a splendid foundation. The east end of the puddle keys into a deep trench sunk to the surface of the granite ledge which slopes at a steep angle towards the centre of the glacial valley.

The extreme height of the crest above the lower toe of the dam is 98 feet. The total volume of the dam is 530,000 cubic yards, of which 32,600 cubic yards represent the rock used in the toewalls and the riprap, the balance being sluiced material.

A perusal of the above particulars concerning the Coquitlam dam will show that the work was planned along generous lines, the dam standing at the head of its type as regards sectional area.

The spillway is located at a point separate from the dam, being at the east end and formed by cutting through

the solid rock, forming a spur of the ledge. The spillway is 150 feet in length and 250 feet wide at its entrance, tapering to 185 feet on the down stream side. It is placed at elevation 503, fifteen feet below the dam crest and its construction involved the excavation of 75,000 cubic yards of



Land clearing operations on portion to be flooded

material, of which 53,000 cubic yards was rock. The capacity provided by the spillway is 12,000 cubic feet per second when the water is 7 feet deep over the sill. On the west side of the spillway is being cut a channel 20 feet wide and 7 feet deep for the removal of drift on the surface of the lake, this being provided with a movable dam so that no water may be wasted.

During the construction period the water from the lake is being diverted through a tunnel carried through the ledge, under the spillway, which will later be used as an outlet or sluice tunnel. This tunnel is 490 feet in length and has a sectional area of 400 square feet. Its width is 26 feet and the height to the centre of the roof, which is semi-circular, is 18 ft. 6 in. A fall of ten feet prevails through the tunnel, which was planned to carry 12,000 cubic feet per second when the lake is at elevation 475. To carry the water to the tunnel a channel has been excavated 860 feet in length and 40 feet wide at the bottom, with sides on a slope of $1\frac{1}{2}$ to 1, this work demanding the removal of 202,000 cubic yards of material. On the lower

side of the dam the diverted stream was allowed to cut its own way back to its former course only 80,000 cubic yards being excavated to keep it in check.

When the dam is completed the flow of water through the sluice tunnel will be regulated by gates controlled from a concrete tower and gate house built over the tunnel and connected with the lake shore by a concrete bridge. These gates are each five feet in diameter. Inclined racks to prevent material drifting into the tunnel and auxiliary gates for use when the sluice gates are being examined are also arranged.

The water supply of the city of New Westminster is taken from Lake Coquitlam and the construction of the new dam made necessary the provision of a new intake. This work was assumed by the company which has erected a heavy circular concrete intake tower on a spur of the bedrock extending into the lake, the structure being connected with the shore by a concrete bridge. The tower is of 18 feet inside diameter with walls 4 ft. 6 in. thick at the bottom, which is located at elevation 428, tapering to 18



Preliminary Work on toe-wall of dam—Lake Coquitlam



General View of operations of B. C. E. R. Company at Coquitlam Dam

screens, these being provided in duplicate. Within the tower a secondary intake is placed consisting of a standpipe 42 inches in diameter. This is in four sections, each having conical seats on the ends and resting on the one below it, the bottom section resting on a heavy cast iron elbow on the tower floor. The intake pipe sections are firmly guided by heavy rails bracketed into the tower wall and are operated by hand. At the base of the tower a channel, 20 feet wide and with sides sloping at $1\frac{1}{2}$ to 1 is cut to the deep water of the lake. From the intake tower the water supply is conveyed to the mains leading to New Westminster through a tunnel 1,938 feet in length extending around the east end of the dam and connecting with a distributing chamber near the lower toe of the structure. This tunnel is chiefly driven through rock where it is 6 ft. 6 in. high and four feet wide and has a concrete-lined floor. For 508 feet of its length, however, rock work was impracticable and for this distance a steel pipe, 4 feet in diameter and encased in concrete is provided.

The company's operations at Lake Coquitlam will cause the flooding of 1,000 acres of wild land nearly all of which is covered by timber averaging about 30,000 feet board measure to the acre. On account of New Westminster taking its water supply from the lake the Dominion authorities advised that this land be cleared and this extensive work is now in progress. The clearing is being done by hand or with the aid of a donkey engine, according to location, the marketable timber being left to be floated down the lake during the period of high water. The company is now constructing a logging railway from the dam to Port Moody at the head of Burrard Inlet, which will be utilized for the delivery of these logs to the mill as well as for general log deliveries from the extensive private limits which it taps.

The preliminary work on the Coquitlam dam was started in the winter of 1908 when clearing work was done on the 60 acres covered by the actual dam operations and exploration work carried on for ascertaining the character of the foundations. During the following winter the pumping plant



Hydraulic operations on the discharge canal

was installed and in 1910 work was started on the stripping of the dam foundation and the excavation for the diversion channel.

Excavation work on the project has been chiefly carried out by the hydraulic process and, taking the work as a whole, this method has been more successful than had steam shovels been used. All the flumes used in the excavation work are made of timber, are rectangular in shape and 20 inches in width, the bottom being lined with $\frac{1}{4}$ in. steel plates. On one section of the excavation where the cut was

made through boulder clay banks, the flume having a grade of over 3 per cent., 11,000 cubic yards were taken out in a working week of 120 hours. In this case one jet delivering 10 cubic feet per second at a nozzle pressure of 110 pounds was employed. In the excavation of the cemented gravel and boulder formation drilling and shooting was followed wherever practicable. On the cemented gravel it was frequently found that the best results were obtained by the hydraulic method, a high pressure jet being used at close range. In excavating the lower levels recourse was



Steel pipe for New Westminster water supply

had to hydraulic elevators to lift the material to the flume level and the boulders were removed with a dragline bucket or derricks and dumped into the rock wall forming the toe of the dam.

In the construction of the New Westminster water intake tower a cofferdam was built at the point chosen, the sheet piling being driven into the silt forming the lake bottom. The excavation at this location was 10,000 cu. yds., 8,500 of which was sluiced by the hydraulic method and lifted by a hydraulic elevator.

In carrying on the work on Lake Coquitlam, the company operates a small tug boat the "Nortona," which is used for the carriage of materials to the various camps, and also in taking the men to their work on the clearing operations at the head of the lake.

Particular attention has been given by the company to the sanitary condition of the camps, and sanitary experts who have visited the place declare that the company's provisions in this regard are well nigh ideal.

The sluicing of material into the dam will be started during the present summer. As the borrow pits are advantageously located, the choice of material is wide and the grades good, this work should proceed very rapidly.

The construction of the dam is being carried on under the direction of the Vancouver Power Company, a subsidiary organization of the British Columbia Electric Railway Company, Limited. The work is being done under the direction of R. H. Sperling, General Manager; G. R. G. Conway, M. Inst. C. E., M. Am. Soc. C. E., chief engineer, assisted by W. V. Hunt, hydro-electric engineer; Fleming Ramasaur, resident engineer at the dam, and R. Lea, assistant engineer. In carrying out the project J. R. Freeman, M. Am. Soc. C. E., is acting as advisory engineer for the Dominion authorities, and R. S. Stronach is supervising the work on the ground under instruction from the water powers branch of the Department of the Interior.

Tests of Hydro-electric Generating Units

An Article Directing Attention to the Great Value of Actual Operating Tests on Both Generators and Turbines, with a Detailed Account of the Most Approved Methods of Making the Tests

By A. J. Soper and K. R. McKinnon

The necessity and value of making operating tests before placing a hydro-electric station in service are generally recognized. The proper choice of equipment to meet the operating requirements depends, to a large extent, on the ability of the consulting engineer who draws up the specifications and contracts between the purchaser and manufacturing companies. However, it is often found that the generating units do not meet the requirements of the specifications or the guarantees included in the contract. This may be due to mistakes in design, or defects in the construction and installation of the apparatus. If these are not discovered and remedied before placing the generating units in service, such a loss of income, or prestige, and heavy expenses for repairs or replacements may be experienced on account of failure to meet guarantees or breakdowns that instead of being a good paying proposition the development becomes a failure. No plant should be placed in service before careful tests have been made to make sure that the apparatus in the station will successfully meet the conditions which will be experienced under operating conditions.

An ideal generating unit might be defined as one consisting of a turbine capable of delivering its full rated load and generating power at maximum efficiency, connected to a generator which changes the mechanical energy to electrical energy at maximum efficiency and is capable of delivering the full output of the turbine, while otherwise, the design and construction of the unit are such that it will withstand the severest service conditions without failure. It is not often that such an equipment is found in a power station. Frequently we meet with cases where the capacity or efficiency of the turbine is low, the turbine is too large for the generator or vice versa, the generator efficiency is low, or the apparatus has defects in design, construction or installation which produce trouble. It might be well to point out here that all failures to meet guarantees cannot be attributed to mistakes on the part of the designer of the apparatus, as, frequently, the troubles can be traced to defects in the design of the station such as incorrect hydraulic setting for the turbine, poor arrangement of the apparatus in the power house, etc.

As an example of conditions which are sometimes met with let us consider a development of five units each having a maximum capacity of 5,000 h.p. Suppose the turbines fall short of their rating by five per cent. or in all 1,250 h.p. At \$20 per h.p. this would produce per year a revenue of \$25,000, which, capitalized at five per cent., would represent an investment of \$500,000. Again, let us assume the capital cost at \$100 per h.p. The remainder of the development has been constructed for the full capacity of the turbines, that is, approximately \$125,000 is invested in such a way that it produces no revenue. The same reasoning can be applied to a plant depending on storage where low efficiency of the turbine, or generator, results in the loss of revenue.

A number of tests of the generator can be carried out satisfactorily at the factory, but it is advisable to make some of the tests in the power house after installation, while it is necessary to make all of the tests on the turbine after it is installed. The scope of this article is too large to include test data and discuss the same in detail and it is only intended to describe in a general way the results of some experiences while carrying out tests at hydraulic stations

together with a short discussion of the same. The article is presented with the hope that others will become interested enough in the work to contribute to this branch of engineering, as up to the present time only a small amount of literature has been presented on the subject.

The tests might be classed under two divisions, electrical and hydraulic, although, in some cases they are so related that it is possible to carry out the tests under the two divisions at one time. In this article, for the sake of clearness, the two divisions will be discussed separately.

Electrical Tests

The following testing equipment will be required for carrying out the usual tests of a modern three-phase generator,—

- 2—Portable a.c. ammeters, 0-5 ampere capacity.
- 1—Portable a.c. voltmeter, 0-150 volts.
- 2—Portable wattmeters, 5 amperes, 150 volts.
- 1—D.C. milli-voltmeter with necessary shunts.
- 1—Portable d.c. voltmeter, 0-150/300 volts
- 1—Portable polyphase wattmeter.
- 1—Portable polyphase recording wattmeter.
- 1—Speed counter.
- 1—Tachometer.

Thermometers.

- 2—Portable current transformers with windings interchangeable so as to give different ratios.
- 2—Portable potential transformers suitable for use on the low tension voltage of the station and giving a secondary potential of 110 volts.

With the above, should be included the necessary wire, cable and switches for loading the electrical apparatus and making the meter connections. Before making tests, all instruments should be checked with standards and the ratios of the instrument transformers obtained while loaded with the instruments with which they will be used during the tests. The tachometer and thermometers should also be carefully standardized.

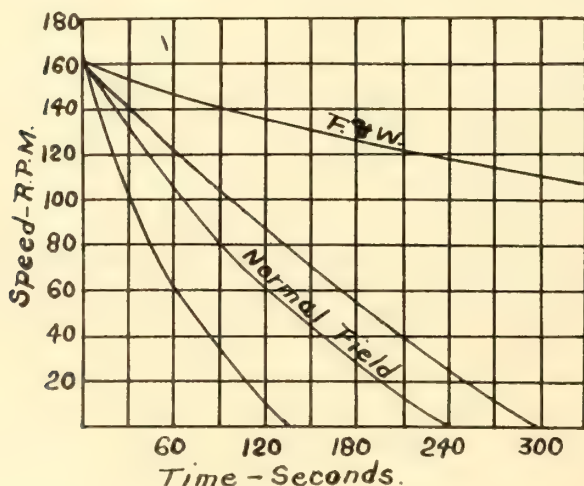
Generator Efficiency.—It is important that the efficiency of the generator be accurately obtained if it is to be used for loading the turbine during the efficiency and capacity tests of the latter. This efficiency is usually obtained in the factory by indirect methods, that is, the losses are measured separately and the efficiency values at different loads are calculated. To carry out these efficiency tests, the generator is driven by a motor and the input to same noted under different conditions. By deducting the losses in the motor from the total input, the amount of power required to overcome the generator losses is obtained. In this way, the friction and windage, iron losses and short circuit core loss are obtained. The copper losses are calculated from the measured resistances of the armature and field circuits corrected to the operating temperatures. This method in general gives accurate results, but in some cases, the calculated efficiency does not represent the efficiency of the generator under operating conditions. This is due to the fact that the load losses are greater in value than the calculated losses. The extra load losses are produced by eddy currents in the copper conductors and it is a difficult matter to accurately measure the value of these losses. The usual method of measuring these extra copper losses is to short

circuit the generator windings and note the input to the driving motor for different values of armature current. The motor losses, friction and windage of the generator and generator I^2R losses are deducted from the motor input and the balance represents the extra losses in the copper conductors. In this test, the armature current is practically wattless and so it is claimed that the eddy current losses in the conductors are greater than the losses obtained under operating conditions. The Standardization Rules of the American Institute of Electrical Engineers recommend that one-third of the measured short circuit core loss be used in calculating the generator efficiency, and this proportion is generally used. The short circuit core loss will usually be found small when compared with the total losses and so has a very small effect on the calculated efficiency of the generator.

The copper losses due to the eddy currents referred to previously are produced in large conductors by the action of the alternating current passing through the circuit. Eddy currents are also sometimes produced in the armature conductors by the fringing flux from the field poles, that is, a part of the main flux cuts the top of the conductor only, thus producing a difference of potential between the top and bottom. This produces currents with resultant extra losses. These extra losses are measured with a fair degree of accuracy in conjunction with the iron losses. However, under operating conditions when all of the losses in the generator are occurring at one time, the conditions are somewhat changed from those obtained during the measurements of the separate losses, with the result that the operating losses are somewhat greater than the measured losses used in the efficiency calculations. The turbine builder will usually dispute the accuracy of the generator efficiency calculated from the separately measured losses, and in order to remove doubt, it is sometimes advisable to use the total measured short circuit core loss in computing the generator efficiency.

The Retardation Method

In a large number of cases it is impossible to set up and run the generator in the factory, and this necessitates making efficiency tests after erection. The retardation method is usually used in such tests to determine the friction and windage and iron losses of the generator. The stored energy in a rotating body can be represented by $I\omega^2/2$ where I is the moment of inertia, and ω is the angular



Retardation Curves of Generator

velocity. This expressed in watt seconds is $0.545 \times I n^2 / 10^9$. To carry out tests by the retardation method, the generator is brought up to above normal speed either by a motor or the water turbine. If the exciter is direct connected to the generator, it can be used to advantage in bringing the

generator above speed. If the turbine is used, it is necessary to provide a clutch coupling between the two units which will allow the turbine to be easily disconnected from the generator after the required speed is obtained. The speed of the generator is noted at different intervals after the driving power is shut off and plotted on a time basis. The energy lost by the rotor during a definite length of time equals $(I\omega_1^2/2 - I\omega_2^2/2)$ where ω_1 and ω_2 represent the angular velocities at the beginning and end of the interval. For example, if readings are taken at $\frac{1}{2}$ minute intervals, the average power absorbed by the losses at an average velocity of $(n_1 + n_2)/2$ would be $0.545 \times I \times (n_1 - n_2) / 30 \times 10^9$ watts. From a series of such values curves can be plotted to show the watts consumed by the generator losses at different speeds. The watts absorbed at normal speed can then be read from the curve at the point where it intersects with the ordinate corresponding to full speed. All of the generator losses, with the exception of the I^2R copper losses, can be obtained by the retardation method. The copper losses can be calculated from the resistance measurements. The separate losses, at different loads, can then be used in calculating the generator efficiency.

It will be noted that it is necessary to know the value of I , the moment of inertia of the rotor, in order to determine the losses. The value of I can be calculated from the weights of the different parts but, as this is a rather tedious operation, it is sometimes determined by making a separate observation, as previously described, of one of the generator losses, such as the friction and windage at normal speed. This value of the friction and windage is then used to eliminate the value of I from the formula given previously.

The writers have planned to try out another method of determining experimentally the value of the moment of inertia, but up to the present time have not found a convenient opportunity. The generator would be run above normal speed and loaded with a constant load on a water box. The driving power would be removed, and a retardation curve obtained. During the time this curve is being taken, the load on waterbox can be held constant by adjusting the position of the rheostat. Another curve can be similarly obtained by using a different load on the rheostat. From the load readings, and the retardation curves, the value of the extra losses can be eliminated, and the results used in calculating the moment of inertia of the generator rotor.

There are a number of engineers, chiefly those connected with turbine manufacturing companies, who question the accuracy of the methods previously described for obtaining the efficiency of a generator. In considering methods where the separate losses are used in calculating the efficiency values, it is well to bear in mind that a considerable error can be made in the measurement of any of the separate losses without affecting appreciably the calculated efficiency. The greatest chance for error is in the measurements of the extra losses in the copper conductors. For a generator with well designed slots containing small or stranded conductors, it is conservative to assume that the calculated efficiency will not exceed the operating efficiency by more than one quarter of one per cent. This is well within the errors which may be expected in measurements of the water consumption of the turbine.

Considerable space has been given to a discussion of generator efficiency on account of its importance in connection with another part of this article dealing with efficiency and capacity tests of the turbine. Before taking up any of the other tests of the generator, a convenient method of loading a generator on a water rheostat will be described.

Water Rheostat Used as Load

A useful water rheostat can be made from three iron pipes two and one-half or three inches in diameter and

about ten feet in length. The pipes are blocked triangularly so as to be spaced about 18 inches apart for voltages below 3,000. Two wooden supports, one near the top, and the other near the bottom of the pipes are so arranged that the latter fit in the corners and are held in position by small bolts which pass through the overlapping ends of the supports. The tops of the pipes are threaded for a few inches from the ends so that cables which carry the load can be attached by interlacing the strands. The top support can be used for attaching a block and tackle for lowering and raising the water rheostat. An elbow section of pipe so arranged that the rope from the block and tackle is wound about one arm while the other arm is used as a

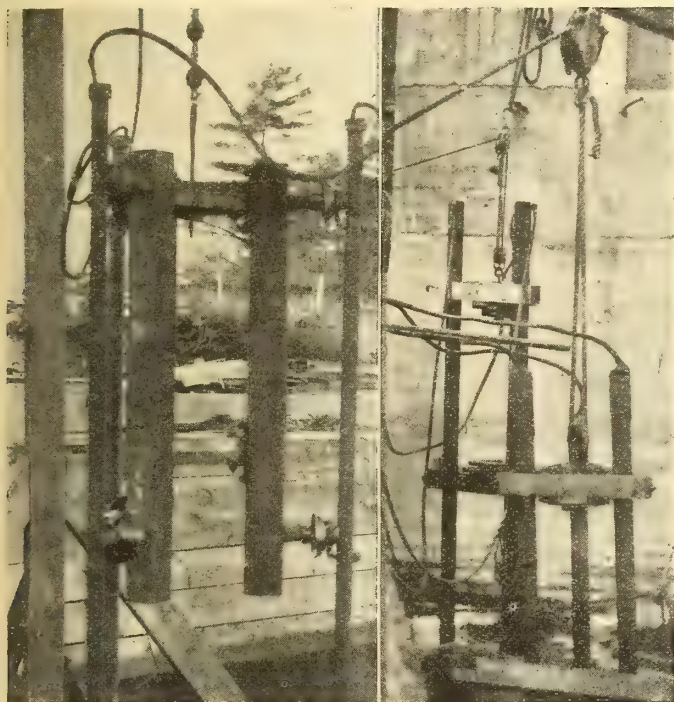
ly be found in the fore-bay or tail-race. If a water box is required, this can be manufactured out of rough planks as a few crevices only assist in keeping the box cool. Care should be taken that the box is of sufficient size to carry the load without excessively over-heating the water. A box not less than 6 x 8 x 10 feet in depth is recommended if the load exceeds 2,000 kw. Such a box can be loaded with stones until it is almost submerged in the water.

Regulation Test.—Two generators are required for this test. The units are operated in parallel so as to supply load to the water rheostat. The turbine gate of one unit is closed so that the generator will operate as a synchronous motor and its field current is adjusted to give the required power factor to the generator supplying power to the rheostat. Readings of the field current of the unit operating as a generator are taken while operating at rated speed and voltage under different conditions of load and power factor. The corresponding no load voltages for the above values of field current are then observed. The difference between the no-load voltage and the rated voltage, expressed as a percentage of the rated voltage, gives the regulation of the generator as it is usually expressed.

The regulation obtained by this method of testing will be found to exceed the values which are usually obtained at the factory from the saturation and synchronous impedance tests by combining the magneto-motive forces. It is important that the regulation of the generator be obtained while delivering the maximum output of the waterwheel at the lowest power factor that can be expected for the station. It is now general practice to operate hydro-electric stations with a Tirrill regulator to control the station voltage. Under such conditions generators having a comparatively high regulation are installed, as the regulator will take care of sudden change in load and the large reactance of the generators will decrease the line current in case of short circuits. Observations should be taken of the generator field voltage, while making the regulation tests to make sure that the exciter voltage will be large enough to pass the required current through the field windings while operating at maximum load and lowest power-factor.

Heat Runs.—Temperature tests should be made in the power house under operating conditions before placing the generators in service. These tests are, without doubt, the most important of all tests of the generator after installation, due to the fact that it is generally impossible to make satisfactory heat runs in the factory. The usual methods of artificial loading used in factory tests, such as the open delta d.c. method, frequently give results which differ considerably from the temperature rises obtained under the operating conditions. The best method of making a generator heat run in the factory is the zero power factor test which is carried out by operating two units of about the same size at one time, one acting as an under-excited synchronous motor and absorbing the wattless load of the generator under test. Although this method gives more reliable results than those usually employed, the temperature rises obtained are not a safe indication of the results that may be expected under the changed conditions when operating.

In the factory test the generator is usually set up in a large shop so that an ample supply of fresh air comes in contact with all parts of the machine, but in the power house, different conditions may be obtained. As an example, we can consider a horizontal generator which in the factory test might be set up at some distance from the floor but in the station might operate with the lower half partly enclosed in a pit; also with several generators operating at one time the air currents in the power house will not have the same freedom as in the factory with resultant higher temperature rises. The designs of the power house and generators should be so related that the generators



Types of Rheostats—To the left a 6600 v., to the right two 2400 v. parallel Resistances.

lever, is convenient for lowering or raising the water rheostat by degrees. It will generally be found necessary to use a water box in conjunction with the rheostat if the potential of the generator is lower than 3,000 volts. This will depend on the value of the load the rheostat is required to carry and on the conductivity of the water. If the water has medium conductivity this type of rheostat will carry a load in excess of one thousand kw. when operating at 2200 volts. If a water box is used with the rheostat and salt added to the water, a load in excess of three thousand kilowatts can be carried without inconvenience. This type of rheostat has been found to be as satisfactory as another type in which iron plates of such size as to expose about fifteen square feet of surface per plate were used. This indicates that an increase in the area of the exposed surface has a small effect on the total load that can be carried by the rheostat. The pipe type of rheostat is recommended as the necessary material can generally be found at the power house and it can be made up easily. The value of the load that the rheostat is capable of carrying increases with the voltage, but for potentials above 3,000 volts it is advisable to increase the spacing between the pipes. There is a considerable difference in the conductivity of water in different parts of the country, for example, a rheostat of the type described above when used in the Trent River would carry several times the load that similar rheostats would carry under the same conditions in the Cobalt and Nipissing districts.

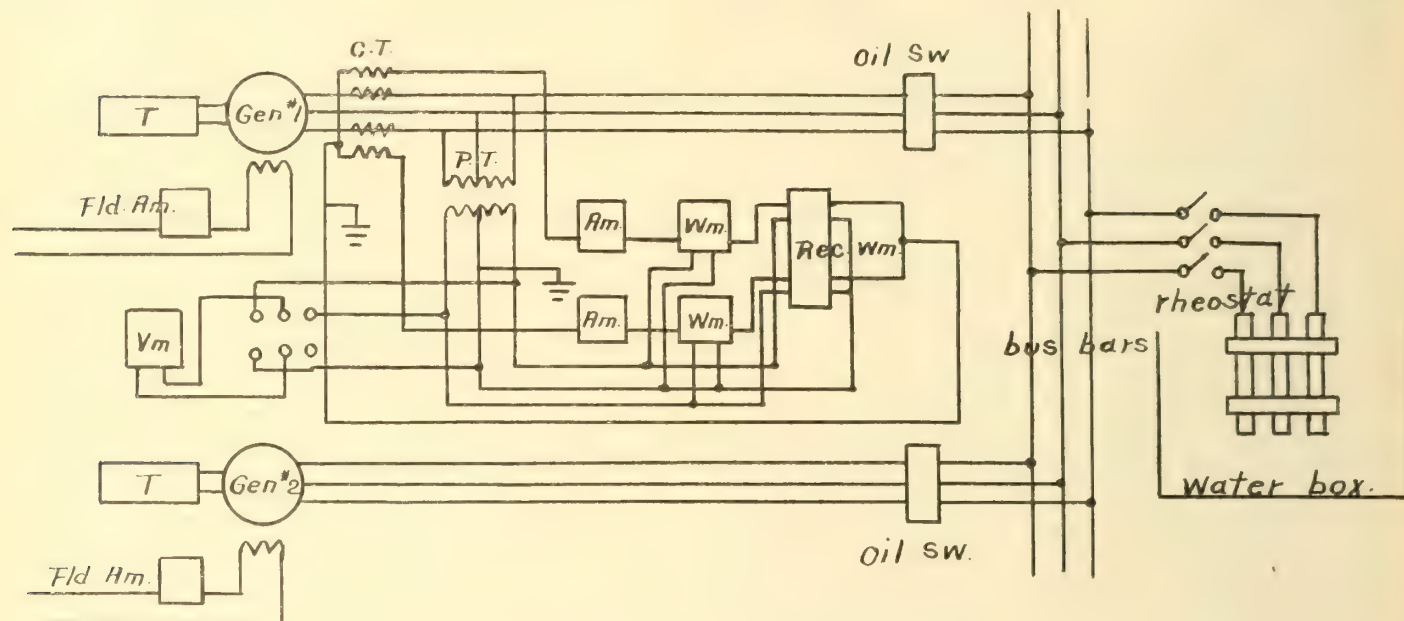
A convenient location for the water rheostat can usual-

will deliver all specified outputs under the severest service conditions without exceeding the limiting temperature rises. This calls for close co-operation between the designers of the power house and the generators as, in some cases, it is advisable to provide special means of ventilation, such as enclosing the generator and conducting the warm air to the outside of the power house through ducts. In such cases it has been found that the friction and windage losses are decreased by almost one half their value as measured before enclosing the unit which shows that the churning up of the air near the generator products an energy loss which raises the temperature near the machine and thus reacts on the temperature of the windings, iron, etc.

If the insulation of the armature or field coils is operated at a high temperature, it deteriorates until a burnout

in the indication of the thermometer. A convenient method for covering the bulbs of thermometers located on armature coils is to use a small square of soft felt. In some cases putty can be used to cover the bulbs of the thermometers to advantage but this is not generally a satisfactory method as the putty is likely to soften and when it hardens it spoils the appearance of the machine.

From a heating point of view, a generator is no stronger than the one part where the maximum temperature rise is obtained, so, during the heat run, it is advisable to use a few thermometers to explore the generator in order to locate the part which attains the highest temperature, as frequently, one part will have a temperature much in excess of the remainder of the unit on account of air pockets. The hottest part of a horizontal type generator is usually



Wiring Diagram of Generator Test Circuits

occurs. Engineers specify a limiting temperature for generators for different conditions of load and power factor. The usual practice is to follow the recommendations of the Standardization Rules of the A. I. E. E. The safe limiting temperature rise depends on the type of insulating, but in general it is considered unsafe to operate a generator for any length of time at a temperature above 80 deg. C.

Two generating units are required for the heat runs in the power house. The generators are operated in parallel with one unit loaded on the water rheostat and the second unit running as an under-excited synchronous motor to give the required power factor to the generator. The generator output readings, as indicated by portable wattmeters, should be taken every thirty minutes, together with readings of the field current, armature current, armature voltage and speed. Readings should also be taken at the same time on thermometers located on different parts of the generator and the final temperatures should also be checked by the rise of resistance method. It is not advisable to try and carry out temperature tests with a small number of thermometers. Not less than twenty thermometers should be used in testing a large generator. About four of the thermometers should be located so as to indicate the temperature of the air at a height in line with the centre of the generator at a distance of about six feet from the unit. The remainder of the thermometers should be distributed over the ducts, armature iron and armature coils. If waste is used, a sufficient quantity to cover the bulb of the thermometer only is required as a larger amount is likely to form a pocket for warm air and produce an error

found at the upper corner on the side where the rotor approaches the base. This is probably due to the fact that the rising warm air currents meet at this point with currents produced by the revolving element. The part of a vertical type generator which has the highest temperature rise is found near the top of the iron or armature coils, due to the effect of the rising warm air. It is desirable, if possible, to have all the generators in the power house well loaded while making the temperature tests and also to carry out the work on a representative warm summer day so that the severest conditions that can be expected are experienced during the heat run. This is not advocated in order to give the generator a severe test but to prove that it is suitable for all service requirements.

Weakest Point in Coils

The weakest part of a generator from a heating point of view is usually found in the armature coils where they are embedded in the slots. The material which forms the insulation of the armature coil, or between the turns, deteriorates if the temperature becomes too high until a breakdown causes a burnout. It is very necessary to get the temperature of the armature coils at or near the centre of the portion embedded in the iron. Some types of generators are so designed that it is impossible under ordinary conditions to insert a thermometer so as to ascertain the temperature at the centre of the coil. Fair results are obtained by the rise of resistance method, but the calculated temperature by this method is the average for all the coils and usually the temperature at the centre is considerably

higher than the temperature of the end turns. In addition, resistance measurements can only be taken after the load is removed from the generator.

A method that is in general satisfactory for obtaining the temperature at the centre of the coil is to remove two or three of the retaining wedges from the slots and make a small groove on the inside of each wedge of sufficient size to allow a thermometer to be inserted under the wedge so that the bulb will come in contact with the insulation of the armature coil. It may be found necessary to bore holes in the frame to allow the thermometers to be inserted. Special flat thermometers can be made up to meet the requirements for practically any test. Recently a resistance thermometer or pyrometer has been developed for obtaining the temperatures of generator armature coils. A thin flat winding is inserted so as to be in contact with the armature coil insulation near the centre of the slot and fine leads are brought out to the indicating instrument; this method also gives good results. The adoption of special thermometers or a pyrometer so arranged that the station operator could take periodic readings would give valuable results from an operating standpoint and we venture to predict that it will not be long before some such scheme is in general use in large power stations.

The heat runs should be continued until all parts of the generator have reached their maximum temperature. After the final readings have been taken, the load should be shut off and the generator brought to rest as quickly as possible. If the generator is of the horizontal type, a brake can often be used advantageously. As soon as the generator is brought to rest, thermometers are placed on the field coils and iron and also on the teeth of the armature iron. Frequent readings are taken until after the maximum temperatures are attained. Resistance measurements of the armature and field circuits should be taken at the same time and the temperature rises calculated in terms of the room temperature at the end of the heat run. After the generator is brought to rest, it is usually found that the temperatures of all parts will rise above the values attained before the load is removed. The exception is frequently found in the case of the temperature readings of the armature coils at the centre of the slots. This illustrates the importance of bringing the generator to rest quickly and also indicates that in the usual methods of testing the maximum temperatures are not measured.

While the generating units are connected up for the heat runs it is convenient to check up the switchboard instruments with the portable standards. If a power factor meter is installed on the generator panel, different readings can be obtained by changing the excitation of the unit operating as a motor. The station power transformers can also be tested by supplying power from the generator to a step-up unit while a second step-down unit is loaded on the water box.

Over Speed and Over Potential Tests.—These tests can conveniently be carried out in conjunction with the governor tests. The generator is loaded on a water box and the governor placed on hand control. The load is quickly removed by opening the oil switch and the fluctuations in speed and armature voltage noted. An oscillograph can be used to advantage in this test to note the fluctuations in frequency and voltage.

Short Circuit Tests.—This test is usually carried out at the end of a heat run while the generator windings are near their maximum temperature. An oscillograph is required to obtain the best results in this test. The short circuit can be conveniently made for the specified time and disconnected by an oil switch. The writers have obtained some interesting results with an oscillograph in short circuit tests but feel that a description of these tests is be-

yond the scope of this article. The temperatures of the armature coils should be carefully noted at the end of the short circuit test.

Measurement of Generator Output in Turbine Tests.—

In turbine tests where the generator is used, the latter is loaded directly on the water box thus giving a unity power load. The best results in measuring the output of the generator are obtained by using indicating ammeters and voltmeters, indicating wattmeters and a recording wattmeter. The recording wattmeter is of special value as it takes care of small variations in the load, while the readings on the other instruments serve as a check. In calculating the generator input, corrections should be made for errors in the instruments and transformers and the efficiency of the generator should be taken at the operating temperature. As the field is separately excited allowance should be made for the field copper loss in considering the generator efficiency. Special friction dynamometers have been developed and used to a certain extent in the United States for loading and measuring the output of water turbines. These dynamometers are set up with difficulty in many cases and they require careful attention during the tests to prevent errors, so it is generally considered satisfactory to use the generator for measuring the turbine output.

Testing the Turbines

While it has become general practice to make more or less complete tests on the electrical apparatus in a generating station, the turbines are frequently taken over without any test being made other than a capacity trial to see if they develop the power required of them. As mentioned previously in this article, a loss of power through the poor efficiency of either turbines or generators, means a great increase in the capital cost of the plant. Hence efficiency tests on the turbines are of extreme importance and should never be overlooked in a development of any size. Particularly is this so of high-head developments, where storage is of such great importance. A few per cent. either way in efficiency may regulate the capacity of the station for continuous power to consumers to such an extent that large contracts for power may depend on this very point.

Except for the instruments which are required for making tests on the electrical equipment, these tests can be made without going to any great expense. Tests on turbines, however, if carried out with a view of obtaining accurate and reliable results generally require a considerable expenditure of money. The result is that in this country, turbine tests are generally approximate, and are only of use in determining, in a general way, whether or not the contractor has fulfilled his guarantees.

In Europe it is different. There, in the estimates for any plant, a certain sum is provided for testing equipment, and upon completion of the plant, tests are made in minute detail. The advantage of this plan is that tenderers know that they must not submit guarantees which they cannot meet. They have no means of escape, and therefore to be on the safe side, they submit figures which are several per cent. below what they expect to reach under test.

As a contrast to this, one sees in this country in some cases guarantees of efficiency which are the maximum that the tenderer hopes to reach. This is done in cases where it is pretty well assured that accurate efficiency tests will not be made, and where legal objection could be raised to results obtained by approximate methods.

Tests made at Holyoke have served as a standard of comparison to such an extent that it has been considered a waste of money to install expensive equipment for tests in place. This is done notwithstanding the fact that the results obtained in many plants which have been accurately tested, have shown considerable difference from the results obtained at Holyoke. A wheel may give excellent re-

sults amid the ideal conditions of the testing station, and may then be placed in an improperly designed casing, with poorly designed guide apparatus, regulating mechanism, or draft tube. A test in place will show up the defects in the whole unit, and not merely in the runner.

One feature of the hydraulic power plant work in this country which is detrimental to accurate testing, is the rush with which the plant is generally completed. The units are frequently put into service before the general works are completed, and in many cases temporary equipment is required. By the time the plant is in shape to test, the load is so heavy that shut down for test is impossible. This applies to turbine tests only. The governors can easily be tested at any time after the plant is in operation.

Turbine Tests.—The points which should be covered in a complete test on a hydraulic turbine are as follows:—

- (a) Capacity.
- (b) Efficiency.
- (c) Proper operation.

Capacity tests can be made with very little trouble or expense. Normal conditions of operation should be obtained as closely as possible. The head should be kept constant and headrace and tailrace levels should be normal. If the head differs greatly from that on which the contractor based his guarantees, and the unit proves to be under capacity, he will almost surely object to the test and will demand one at normal head. However, it is a well established fact that provided the speed of the turbine is varied as \sqrt{H} , the capacity will vary as \sqrt{H}^3 and, for small variations in head, this ratio is acceptable. However, any great variation in speed will effect the efficiency of the generator, and it is well to provide against any objections being made on that score. Line load may be used for the capacity test, but it is preferable to load the generator and water rheostat; better control over the speed, load and voltage can be obtained. The gates should be opened to the maximum

bine. In units operating on pipe lines the losses in the pipe line must not be charged against the turbines. Similarly in low head plants headwater readings should be taken close to the turbines inside the racks.

Several check readings of all quantities should be taken at the position of full gate. If desired, a series of readings at the various gate openings can be taken from which a curve of power on gate base can be plotted.

Efficiency.—Efficiency tests of turbines are made by measuring the power output at different gate openings, by the methods suggested above, and comparing with the power input, or theoretical power supplied to the turbines. The power supplied equals $QdH/550$ where Q = quantity of water supplied to the turbine in cubic feet per second, d = the density of water, 62.5 lb. per cu. ft., and H = net head on turbine in feet, therefore efficiency =

$$\frac{\text{output of turbine}}{\text{input of turbine}} = \frac{\text{output of turbine}}{QdH/550}$$

In this equation all the factors can be calculated by methods already explained, except the quantity Q . The measurement of this factor presents the greatest difficulties of the tests.

There are four common methods adopted, viz:—

1. Francis weir.
2. Current meter.
3. Pitot tubes.
4. Floating curtain.

The Francis weir.—This is commonly used in plants when small quantities of water are to be handled. The weir must be built in the tailrace, and in large installations causes great inconvenience. If it is built across the whole tailrace the other units of the plant must be shut down during the tests. A weir which would take care of the discharge from one unit comfortably, would block the tailrace and would cause a loss of head when other machines are running.

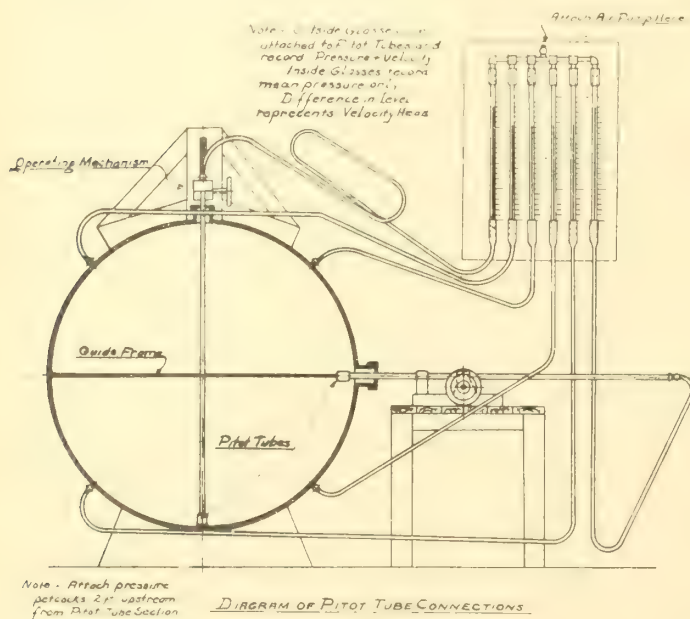
It would mean that the whole plant would be tied up or greatly inconvenienced from the time the weir was installed, until it is removed. If the weir is built for one unit only, the tailrace for that unit must be separated from that of the others by a watertight dam for some distance, with the weir at the discharge end. The level in the tailrace of the unit under test must be high enough above the normal tailrace to give free discharge over the weir.

European engineers have always questioned the accuracy of calculations based on the Francis formula, when applied to large quantities of water. In general the method is not a satisfactory one for use in testing large plants.

Current Meter.—The commonest method of the four is the use of a current meter. Accurate results can only be obtained with a uniform flow of water and arrangements must be made to take the readings across a section which is some distance from any point of disturbance.

If the plant is supplied through a canal there may be some point where the section is uniform, and where a good uniform flow may be obtained. There is the objection that the remainder of the plant must be shut down; and owing to the leakage through the other units, certain inaccuracies will occur in the results.

In a plant with an open frontage, the entrance piers of the wheelpits are generally too short to allow the water to flow uniformly, and a wooden flume should be built to guide the water to the turbine. Readings should be taken at a point some distance from either end of the flume. Sufficient should be taken to give a good average result. For flumes say 18 ft. x 16 ft. in cross section readings should be taken every 2 ft. 6 in., both vertically and horizontally. The load must be kept absolutely constant. The length of the test depends on the rate at which readings can be taken



position, and when conditions of headwater, tailwater, load and speed are properly adjusted, simultaneous readings of all four should be taken. The generator output can be read directly by the methods previously explained. From the efficiency curve of the generator, the input to generator, or output of turbine, can be obtained. This is reduced to horse power and corrected for head by multiplying by the factor $\sqrt{H}^3/\sqrt{H_1}^3$ when H = normal head and H_1 = actual head during test.

Care should be taken to measure the head so that no losses from outside sources are charged against the tur-

over the whole section. Such a flume should be at least 25 ft. long. The leakage would be very slight, and fairly accurate results can be obtained.

As an alternative the water may be measured at some section of the tailrace. In low head horizontal installations, there is frequently a long individual tailrace for each unit, where the water is guided in a concrete chamber, before it reaches the common tailrace at the rear of the power house. It may be possible to gauge the water before it enters the main tailrace, but owing to the churning which it receives as it goes through the turbine and the air that is consequently liberated, eddies are formed which frequently make good results impossible. A flume may be built in the tailrace, but here again, as a rule, trouble is encountered with eddies. Under the very best conditions the result obtained by the use of a current meter can only be assumed accurate within two per cent. Only in the case of readings taken in a uniform canal supplying one unit, or in a flume leading to one machine can this limit be accepted. The current meter should be of the very best make with telephone recorder. The maker's calibration table or curve should be

will balance. In general, results should check within from two to three per cent.

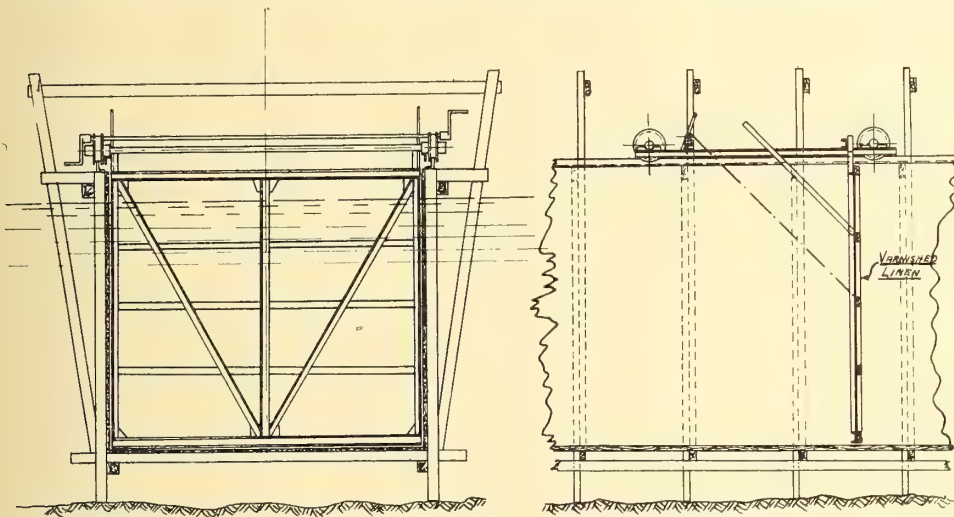
From the reading taken at the pitot tube section, the quantity of water flowing in the pipe can be determined. To calculate the net head on the turbine a pressure gauge should be attached to the turbine casing. The velocity head can be computed for that point. The net head then equals pressure head and velocity head and difference in level between centre of gauge, and tailwater level. Pitot tubes have been used with great success on high head developments. They give reasonably accurate results, and the cost of the testing equipment is small. It can be easily set-up and it is portable and can be used for any number of plants.

Hanging Curtain.—European engineers have adopted a method of measuring the quantity of water supplied to a turbine, which is almost unknown in this country. A flume about 75 ft. long, of rectangular cross section is built in the forebay, or inlet canal. It must be solidly and accurately constructed, and practically watertight. A curtain is made of the same cross section, but with a certain clearance on the sides and bottom, about from $\frac{1}{4}$ in. to $\frac{3}{8}$ in. The curtain may be of canvas for small plants, and of wood, varnished or covered with canvas for large ones. In very large installations a wooden frame work covered with canvas is used. The curtain hangs from a framework which may either float on the surface of the water, or may have wheels and run on rails laid along the sides of the flume. In the former case there is less danger of friction losses, but the bottom clearance must be considerable, or trouble will be experienced with the curtain striking. Arrangements are made so that the curtain may be rapidly moved up and down in the water.

The method of operation is as follows:—the curtain is taken to

the head of the flume, and when the flow has become steady, it is quickly lowered into the water. It is immediately carried along, and as the resistance is slight it assumes the same velocity as the water. A dial on the curtain frame indicates whether it hangs vertically or not. At a point about 30 ft. from the starting point, an electric contact is made. This rings a bell, and the time is taken with a stop watch. Readings are taken on all instruments, head and tail water gauges, etc. Fifteen feet further on another contact is made, and fifteen feet beyond that, a third. Readings are taken in all three cases. The curtain is then caught and lifted out of the water. If there is any considerable difference in the times taken to pass the two contact points, or if the curtain does not hang vertically, it shows that the flow was irregular. The tests take such a short time that a great many can be made, and only those which show regular flow are accepted. The load is kept perfectly constant, as in all other tests. To calculate the quantity of water used at any load a mean value of the time taken to cover the 30 ft. distance is taken. The velocity of the water is assumed to be the velocity of the curtain as measured. The product of this velocity and the cross sectional area of flume equals the quantity used in cubic feet per second.

There is no doubt but this method of measuring the water is the most nearly correct of any of the four which are in common practice. The clearance can be reduced to a minimum, reducing the probability of error to a negligible



Section of Flume and Curtain

checked, if the instrument has been in use for some time. Two complete sets of readings should be taken for each gate opening and the average taken. Readings should be taken at $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, and full gates, and efficiencies calculated and plotted for these gates.

Pitot Tubes.—Pitot tubes are frequently used in tests of plants operating under medium and high heads, where the water is carried in closed penstocks or pipe lines. They work with about the same degree of accuracy as current meters, i.e., two per cent.

The apparatus should be installed at a section of the penstock which is free from eddies. It should be as far up the pipe as possible, to reduce the pressure on the connections. There should be a clear run of penstock of at least 100 ft. without any obstructions such as valves, bends or expansion joints, and the apparatus should be attached as far away from rivet seams as possible. Care must be taken to see that there are no leaks of any kind. Pipe joints should be well covered with red lead and joints between rubber tubes and gauge glasses should be made with shellac and bound tightly with wire.

In making a test with pitot tubes, it is best to divide the area of section of the pipe into a number of annular rings, of equal area, and take readings of the velocity at four points in each ring. A good mean value can be obtained in this way. Individual readings will frequently vary considerably from each other, but if sufficient are taken errors

quantity. For instance, at Svaelfos, Norway, a curtain 17 ft. 0 in. wide x 12 ft. 4 in. deep had a clearance of 3/8 in. on sides and bottom, or 1/3 of 1 per cent. of the total area. The probable error will be less than that amount. In fact, this method, if carefully carried out, assures results which will be as accurate as the observers can read.

It has been used on plants of all sizes and at all heads whether high or low, from testing stations to the largest installations. At Gullspang, Sweden, units of 4500 h.p. under 66 ft. head were tested in this manner, also at Svaelfos, Norway, 10,000 h.p. under 150 ft. and at Trollhattan, Sweden, 12,500 h.p. under 104 ft. In the latter plant, the flume is built of glazed tile and forms part of the inlet canal. It is about 25 ft. deep x 35 ft. wide and over 100 ft. long.

In Europe, this method is the only one that is accepted as being scientifically accurate, and is used in all important cases. The only instance known to the writers where it has been adopted in America is at the plant of the City of Winnipeg, Point du Bois. A long tailrace flume, built of concrete, is to be used for testing purposes, and a curtain is to be used there to measure the flow of the water. The board of engineers in charge of this work are to be congratulated for their enterprise in constructing a first class testing equipment, and it is to be hoped that their example will be followed by others, in future installations.

As has been already noted, the cost of making accurate tests compared with the capital cost of the undertakings, is so small, and their importance so great, that it would well repay the trouble taken and the money spent.

Operation

While capacity and efficiency tests are of extreme importance in any installation, the general operation of the plant is a very important factor. A unit may give first class test results and yet be poorly constructed mechanically.

Leaky stuffing boxes, flexible shafts, hot bearings, unbalanced gates, poor hand regulating mechanism are common defects, which while affecting principally the operating staff, often cause considerable trouble and expense from repairs and replacements, as well as loss of revenue from shut downs. These points should not be overlooked when testing the hydraulic equipment of a plant. For, while it is of greatest importance to produce the maximum amount of power from a given plant and obtain customers, it is also of great importance to have continuity of service, and keep the customers satisfied.

Governors

Certain tests are generally made on hydraulic governors after installation, to see that they meet the maker's guarantees. Different amounts of load are thrown on and off suddenly and the increase or decrease of speed noted. However, the main function of a governor is to regulate the turbine quickly and quietly, without hunting, and to adjust the load between the units of a station. Specifications for governors call for guarantees of regulation based on closing time and fly-wheel effect. Governor manufacturers will frequently boast of surpassing the guarantees submitted in this way. As a matter of fact, the best makers of American and European governors work with no appreciable dead time. That is, the governor begins to act just as soon as the load begins to change. The regulation, for a given fly-wheel effect, depends entirely on the closing time. This may be adjusted to any given figure, say from two to five seconds, so that there will be little difference in the results of a regulation test on different governors attached to the same turbine. The results, however, are useful in calculating the fly-wheel effect necessary to produce a certain percentage of regulation. Also the closing time can be set to the proper figure. For accurate results a recording

tachograph should be used. An oscillograph can also be used advantageously in governor tests.

In general, it is the operation of a governor that gives the most trouble, and the choice should be made from those which give the best service year in and year out, are strongest, most compact, with fewest breakable parts and simplest operating mechanism.

ALUMINIUM CONDUCTORS

The Desirability of Standardizing the Practical Electrical Properties of Aluminium Conductor

By Mr. T. G. Leith

Although aluminium conductors are now in such general use, it would appear that engineers do not fully appreciate that the only tangible effect resulting from their demand for specifications for aluminium conductors that require the maximum possible conductivity and elastic limit mechanically obtainable, is to limit competition, which, it will be allowed, from the viewpoint of the consumer, is a most undesirable feature.

It is possible to produce aluminium conductors having electrical conductivity powers of 61 per cent. (as compared to hard copper, 97 per cent.) with an elastic limit of 15,000 pounds per square inch, but the manufacturer undertaking to supply a large quantity of conductor to meet such specifications is facing a certain possibility of having a large portion, if not the greater part, of the material rejected.

Results obtained from tests made on conductors which were installed on guarantees of 61 per cent. conductivity have in no case fulfilled the requirements, the tests showing an average conductivity of 60.65 per cent. What is the explanation of this material having been accepted? Apparently the engineers calling for the conductors have thought that the manufacturer who undertakes the impossible is likely to obtain the higher results, although he does not meet the required specification. Their supposition may possibly be correct, but one would hardly consider that the manufacturers were obtaining "fair play." Surely the manufacturer that is prepared to guarantee 60 per cent. and delivers 60.5 per cent. is entitled to as much consideration, if not more, than the one who guarantees 61 per cent. and only delivers 60.5 per cent. Would it not be well for the electrical world in general to standardize the conductivity and elastic limit of aluminium conductor practically obtainable?

A well-known engineering firm, of New York city, recently compiled specifications for a large quantity of aluminium conductor. The specifications called for conductivity of 60 per cent., with a tensile strength of 25,000 pounds per square inch and were based upon the results obtained from tests made on samples taken from a large number of high power transmission lines in the United States. Is this not the surest proof of the results practically obtainable from aluminium electrical conductor?

New Publications

The International Electrotechnical Commission has just issued a sketch of the life of the late Lord Kelvin, written by Professor Silvanus P. Thompson. A splendid photograph of Lord Kelvin is shown and the life of this great scientist is given in detail in both English and French. The International Commission is certainly well advised in taking upon itself the publication of matters so generally interesting as the biographies of the world's greatest electrical men.

Please notify us at once if you do not receive your Electrical News regularly.

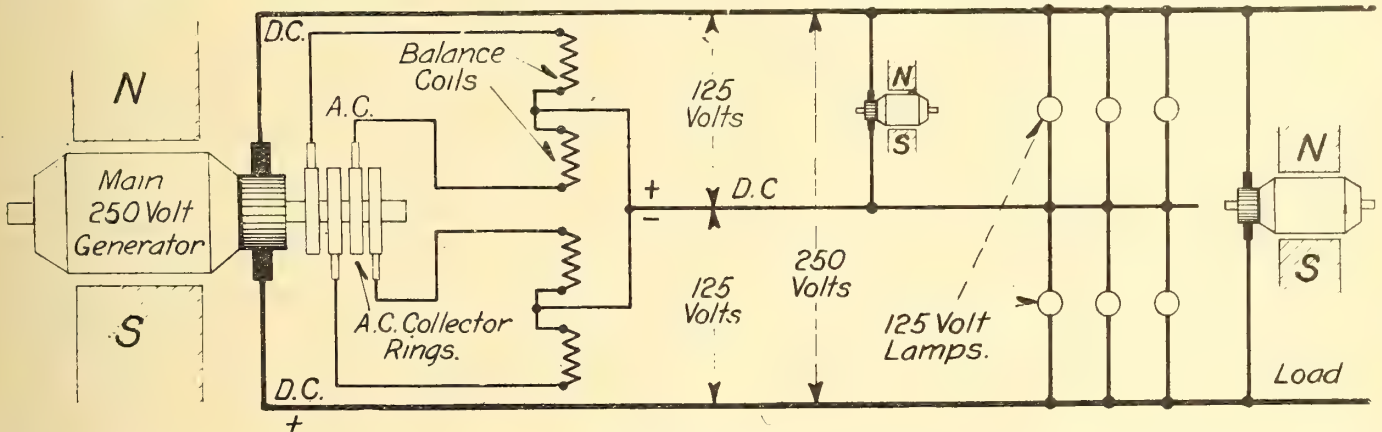
Three-Wire Direct-Current Generators

Three-wire direct-current systems for the distribution of electrical energy at low voltages, were developed during the pioneer period of the art of electric lighting. They have been and are still used extensively for energy distribution for light and power over short distances, largely on account of the copper economies they effect. Current is transmitted at twice the voltage of the lamps or other apparatus, all equipment being connected between the neutral and one or other of the outside wires. The neutral wire carries only the unbalanced current, the value of which is determined by the difference in the loads on the two side circuits of the system. The transmission of current at twice the receiver voltage results in saving of copper cost, with a given energy loss in the line, of nearly two-thirds as compared with the copper cost of a two-wire system of a voltage equal to one-half of the three-wire system voltage. A further advantage of the system is that though the half voltage obtained from either side of the system is often more convenient for lighting and for variable speed motor operation, other power consuming devices operating more satis-

with certain simple parts added to its armature, over a complicated arrangement involving special armature windings, is apparent. Some types of three-wire generators have armatures with special windings imbedded therein under the usual winding. Such windings are difficult of access and are very expensive to repair.

The balance coil (sometimes called auto-transformer), as shown in the figure, is connected across each pair of two-phase collecting rings. This balance coil may consist of a single winding on a laminated iron core, and is similar in mechanical construction to a distributing transformer. The assembled coils are generally contained in a cast iron case similar to those employed for transformers. The middle points of the balancing coils are interconnected, and from this connection the neutral lead of the three-wire system is brought out. The superiority of a stationary balance coil, that can be located in almost any convenient place adjacent to the generator, over a balance coil installed within and rotating with the generator armature, is also apparent.

The performance of the three-wire generator is prac-



factorily on a higher voltage can also be connected across the two outside loads.

The decided advantages of a self-contained three-wire machine for operating three-wire systems as well as the commercial and engineering advantages of a three-wire balanced voltage system many years ago induced manufacturing companies to develop a three-wire balanced voltage generator. The method is of interest at this time because of its recent application to modern commutating pole dynamos.

With the addition of certain parts, any regular single-voltage, direct-current generator can be adapted to provide three-wire voltages. The three-wire system retains all the essential advantageous characteristics of the ordinary three-wire system, and in addition, has the important advantage that only one machine is required. It utilizes a very simple arrangement for obtaining inherently balanced three-wire systems. The principal difference between three-wire generators and standard, single-voltage, direct-current machines is that, with the three-wire dynamo, auto transformers or balance coils (see Fig.) are added and certain connections to the balance coil windings are provided.

The devices that convert the machine from a two-wire to a three-wire generator are so small that a three-wire generator is almost as compact as a two-wire machine of equivalent output. Collector rings are mounted at one end of the armature and the connecting leads to them are similar to those employed on the alternating-current side of a rotary converter armature. The superiority of a three-wire generator, which is merely a standard two-wire machine

tically identical with that of a two-wire generator. The losses in the balance coils are so small as to be negligible. The inherent regulation of the machines is excellent. Standard three-wire generators are wound for 125-250. They may be compounded to impress an increasing voltage with an increasing load, as is the usual practice with single voltage machines. It is customary to divide the series field turns into two parts, connecting one part in the positive and the other in the negative line lead in order that the regulation may be preserved at all loads. Commutating poles assure sparkless commutation from no load to heavy overloads.

The three-wire direct-current system finds its application in the distribution of energy for light and power in office buildings, machine shops, stores, manufacturing establishments, and in all installations where the receiving apparatus is located within a mile or so of the generator. Three-wire generators may be operated in parallel as satisfactorily as two-wire machines. The balance coils are connected directly to the collector rings, and the neutral wire is carried to the switchboard. It is therefore unnecessary to synchronize or connect the alternating-current sides of the armatures in parallel; nor is it necessary to consider the frequency of the alternating-currents generated in the armatures of the different machines. Three-wire generators can be operated in parallel, irrespective of the number of poles and speed of each, just as easily and simply as two-wire generators can be regulated for equal voltage. Two-wire and three-wire generators can be operated in parallel with each other and the latter will handle any unbalanced load.

ELECTRIC RAILWAYS

Street Railway Possibilities in a Small City— Equipment and Cost Tabulated

By J. J. Martindale

In examining the Canada Year Book it is interesting to note that there is a wide divergence in the character of the reports applying to Street Railways throughout the Dominion.

This fact is clearly indicated in the following table which shows earnings per car mile from \$3800 to \$14,600 and an operating expense from 58 per cent. to 102 per cent. of the gross earnings.

Road	Miles	Gross Earnings	Operating Expenses	Ratio of Operating Expense to Gross Earnings	Gross Earnings per Mile
1	11.6	\$93,300	\$54,700	58%	\$8,000
2	4	25,700	20,700	80%	6,400
3	6	29,100	22,600	78%	5,000
4	3.7	54,200	34,300	63%	14,600
5	8	30,800	31,500	102%	3,000
6	7.8	79,700	40,200	62%	10,000
7	5.1	32,300	26,200	81%	6,300

Properties in cities of equal size show large differences in gross earnings and more important, no consistency in net earnings, and it is a study of considerable interest to investigate the possible reasons for such discrepancies and in so doing estimate the cost and revenue from a street railway system in a town of say 10,000 people.

In laying out such a system there are four sections or important points of the town to be tied together by the railway, and they are as follows: business district; residence district; steam railway stations; amusement parks. Now it is readily apparent that if the above sections are so close together that the fifteen minute or twenty minute service (generally offered in such communities) does not and cannot appeal to the majority of the people, of course the number of nickles gathered in will be correspondingly small. On the other hand if these centres are well separated, the public is practically forced to wait for service and accordingly the revenue is steady and large per car mile. An ideal condition would be where the residence district and steam railway centre is in one direction from the centre of the town but each separated from the other by one or two miles so that the property of the company would be in one territory and therefore easier to handle and allowing of more frequent service with the same number of cars than if separated in two or more divisions. It would moreover be a greater convenience to the public.

Parks of Doubtful Value

Parks are of a doubtful value to a street railway property as they are only revenue producing three months in the year and yet the track and wires leading thereto must be maintained the year round and perhaps owing to franchise conditions a service must be given during winter months which is always operated at a loss. However, if winter operation is not required or if the park is located on the main line of travel and the company only keeps the grounds in shape, there is a possibility of obtaining considerable revenue from such a source. The railway company should not invest much money in amusements at such places—the better plan being to lease operating rights to individuals for a nominal sum—they to erect and maintain their attractions.

Now assuming that such traffic producing conditions

exist in our fictitious town and it is therefore worth further investigation, the following questions must be considered,—

What equipment shall be used?

How much will the property cost?

What revenue may be conservatively expected?

How can the property be handled well and economically?

In the first place the property should be well built with the idea of permanence continually in mind and this calls for good material only. Many properties make the sad mistake of using cheap construction and the owners soon pay for their folly. Taking the different construction items in their order, condensed specifications for same are as noted below.

What Equipment is Needed

Roadbed—If in improved city street, cut ditch 11 ft. wide at top and deep enough to allow for 6 in. of ballast and 6 in. of tie as well as depth of rail. If on side of highway and therefore of open track construction, make roadbed at least 12 ft. wide (preferably 14 ft. and 15 ft.) with 1½ x 1 slopes.

Drainage—Make sure to crown the road when track is finished so that surface may drain to gutters and it may be advisable in bad locations to tile roadbed. For open track it is particularly necessary to have drainage of ample capacity and a wise engineer will make the mistake (?) of using larger diameter drains than seemingly necessary.

Ties—6 in. x 8 in. x 8 ft. cedar, with a few oak on curves (or cedar with tie plates on curves).

Joints—Continuous, Atlas or some similar supporting joint with four bolts of 1 in. diameter for closed track and 7/8 in. diameter for open track.

Rail—Approximately 72 lb. high tee for city service. 70 lb. A.S.C.E. for exposed track.

Ballast—Gravel free from clay, 3 in. to 6 in. ballast under tie on exposed track.

Bonds—4/0 electric weld bonds or compressed terminal bond (latter hydraulically applied) of exposed type for inter-urban and concealed types for city work.

Overhead—2/0 copper generally sufficient for trolley wire. Fittings very best that can be purchased. Use enough feeder to give good conditions at end of line.

Poles—30 ft., 7 in. top cedar except in business portion where use approximately 700 lb. 28 ft. steel poles.

Cars—May be second hand but should be inspected before purchase, should allow of wide aisles and entrances and p.a.y.e. operation. Light yet strongly built, having roller bearing axles, centre plates and side plates.

Motors—Purchase reliable motors, if possible at reasonable rates.

Car Barn—Build as near fireproof as possible and protect with ample sprinkler system and waterworks.

Estimated Cost per Mile

Having these specifications in mind it is not difficult to arrive at an estimate per mile of track as noted below in condensed form, assuming a 5 mile property, free right of way and 6 months time to complete the property.

Grading, ballasting and drainage ...	\$2,750 to \$3,100
Ties ...	1,400 to 1,500
Rail ...	4,300 to 4,700
Joints and special work ...	700 to 1,000
Bolts, spikes and washers ...	250 to 280
Track laying, including distribution of ties, and material ...	400 to 500

Overhead work complete	1,550 to	1,750
Bonding	425 to	500
Car barn and sub-station equipment including building, cars, motors	5,500 to	5,900
Organization, contingencies, engineering, office expenses and bond interest	2,300 to	2,700
Grand total	\$19,575	21,930

Earnings

At 60 per cent. operation it will be necessary to realize gross earnings per mile per year of \$3,500 in the first case and \$3,750 in the second case to pay the bond interest and allow a surplus of \$400 per mile or \$2,000 for the property at the end of the year. These earning figures mean that the daily passenger traffic for a 300 day year at an average rate of fare of \$.045 must be 1300 and 1370 respectively or 390,000 and 411,000 per year respectively. Statistics show that if a property is laid out on lines similar to those noted above that it is perfectly reasonable to expect a revenue of \$4000 to \$6000 per mile of track in a town of this size and the system will pay if the same is operated properly.

Upon referring to the table given at the heading of this article, the great disparity in operating expense is at once apparent for out of seven roads shown only one is being handled properly, number one, at a percentage of 58 per cent. This percentage as stated should be reduced to 55 per cent. if a competent, honest, well paid superintendent—one who will supervise track, overhead, car maintenance, and purchasing, as well as operation, is employed. A superintendent worth his salt will handle such a property (with no Sunday work) and be glad to work hard for a good recompense to bring his expenses down. With a secretary and treasurer in one and a stenographer, the office expense is completed and the road is not overloaded, as is frequently the case, with a lot of useless, do nothing officials.

However, consider the effect on the property if the same is operated at 55 per cent. and 50 per cent. The surplus with a revenue per mile of \$3,500 at 55 per cent. operation is now \$2,875 per year or an increase of 43 per cent while with 50 per cent. operation the surplus is \$3,750 or an increase of 87 per cent. An increase in operating expense to 65 per cent. would cut the \$2,000 surplus in half. Thus it is readily seen that in the first place a small increase in construction cost providing it is merited is not worth worrying about, but that the operation of a property can either defeat or realize the ambition and hopes of the promoters of the best designed electric railway in existence, and by the narrow margin of 5, 10 and 15 per cent. in operating costs.

Again referring to the above mentioned table it will be noticed that the largest property listed, No. 1. had the third largest gross earnings per mile at the best operating percentage while the smallest property listed, No. 4, had the greatest gross earnings per mile and what might be termed a fair operating percentage. Also the second largest property, namely No. 5, had the lowest gross earnings per mile and operated at the highest expense. This condition of affairs indicates that there is no consistency to be looked for in such reports and although it is natural to expect the largest property to operate more economically and though such an assumption is perhaps generally true, yet the earnings depend first upon the layout of the system, the natural demands for same and the management, the operating expense depending of course practically entirely upon the management.

Therefore to summarize the above points it is essential that the following conditions should be fulfilled in laying out an electric railway for a small town in order to make same pay a dividend on the investment.

1. Make sure that the conditions are such that the public will ride.
2. Engage a competent, well paid engineer.
3. Use construction of a permanent nature and handle the work expeditiously.
4. Purchase good equipment.
5. Operate the property economically.

1,500 Volt D. C. Sub-Station Equipment—The first of its kind in America

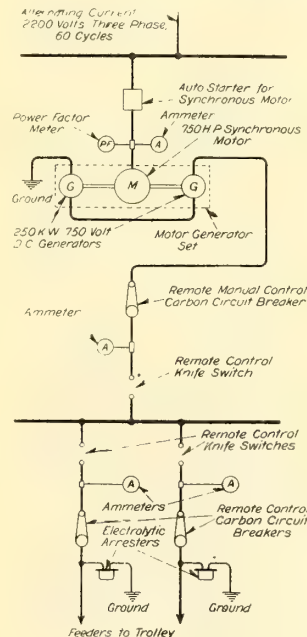
The equipment that was recently placed in service by the Piedmont Traction Company, which has commenced the operation of a very extensive electric railway system in North and South Carolina is of particular interest because the voltage of 1500 is the highest direct-current pressure ever used in this country for electric traction. The property is also of interest because the energy is not generated by the Piedmont Traction Company, but is supplied from the Southern Power Company's lines through nine sub-stations to be located respectively at Charlotte, Gastonia, King's Mountain, Spartanburg, Greers, Greenville, Belton, Anderson and Greenwood. In so far as possible duplicate equipment is used in all of the stations. The 1500 volt direct current is obtained by connecting two 750 volt direct-current generators in series. All the equipment is Westinghouse.

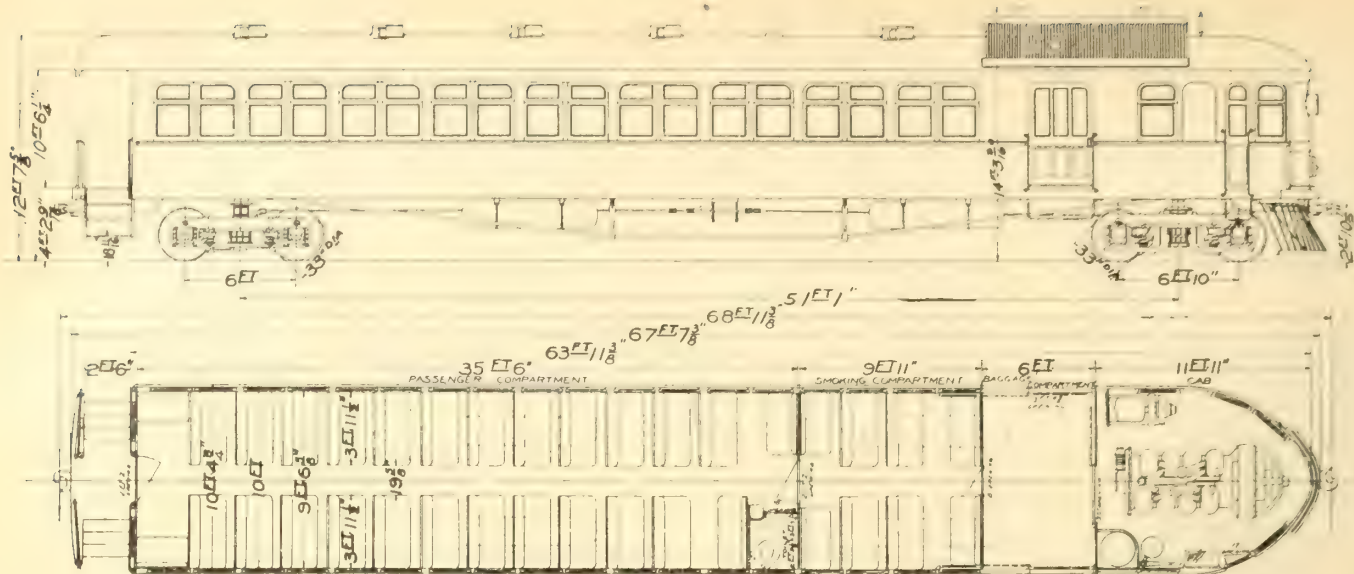
All the motor generator sets are exact duplicates and each consists of two 250 kw., 750 volt. direct-current, compound-wound generators, driven by a 750 h.p., three-phase, 60 cycle, 2400 volt synchronous motor. A 6½ kw., 125 volt, direct-current exciter for the synchronous motor is mounted at the end of the shaft. Two 500 kw., direct-current units have been installed in the Charlotte sub-station, 1 at Gastonia, 2 at Dead Falls, 2 at Belton, a special one at Anderson and one at Spartanburg.

The energy is taken at the Dead Falls station from a 13,000 volt line, and at Belton from a 44,000 volt line which is fed through step up transformers from a 2200 volt line at the Greenville sub-station. In all of the other sub-stations energy is taken directly from the 2200 volt lines and in every case the voltage on the motors is 2200. In all of the sub-stations the switchboard equipment is similar. The schematic diagram shown in the figure is typical of all the sub-stations. The panels are of black marine finished marble.

An interesting feature is that the circuit-breakers and knife switches on the 1500 volt circuits are arranged for remote hand control. Danger of accidents from high voltage flashes is therefore eliminated. In some of the stations a TA voltage regulator has been installed for maintaining the alternating-current voltage approximately constant. It does this by acting on the exciter fields and varying the field excitation of the synchronous motor. Feeders to the trolley circuits are protected by electrolytic lightning arresters.

The Regina by-law authorizing the expenditure of \$150,000 for street railway purposes and \$83,000 for electric light and power purposes carried.





The C.N.R. Gas Electric Car—First of its kind in Canada

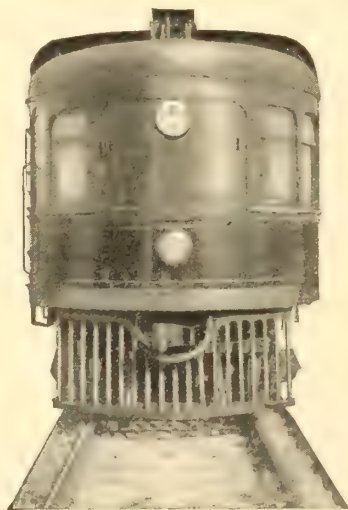
The C.N.R. Gas Electric Car

In the April and May issues of the *Electrical News* brief descriptions were given of the new car that was being constructed for the Canadian Northern Railway Company by the Canadian General Electric Company. This car will operate on a spur of the Canadian Northern main line between Quebec and Lake St. Joseph. The car is driven by a 200 h.p. gasoline, 4-cycle, 8-cylinder engine, direct connected to an electric generator of the same capacity. This generator is an 8-pole, 600-volt machine with frame bolted direct to the end of the engine frame. The generator operates at 550 r.p.m.

On each of the two front axles is a 600-volt, 100-h.p. motor. The motors are box-frame, oil lubricating, commu-



Interior and front end view
C. N. R. Company's
Electric Car.



tating pole railway type, equipped with standard gears and cases.

The car also carries a small auxiliary engine which operates a 125-volt, 1½ kw. capacity generator for supplying current to the interior lights and to a 50 c.p. head light.

The total weight of the car is approximately 50 tons. The operating cost is expected to be in the neighborhood of 22-24 cents per mile. The illustrations show cross sections of the car, also an interior and front end view.

The Rainy River & Radial Railway Company has been granted a subsidy of \$6,400 per mile from Fort Frances to Grassy River and the Ontario Government has added a land grant said to be 1000 acres per mile.

Peterboro Radial

The Peterborough Radial Railway Company have installed three modern pay-as-you-enter cars manufactured by the Ottawa Car Company and using C. G. E. equipment. Extensions to the line are under way, including 4000 feet addition to the Park street line connecting the suburb of Browntown with Peterboro. A recent addition of a 250 kw. unit has also been made to the d.c. equipment in the company's generating station.

Nipissing Central Extensions

The Nipissing Central Railway has under construction an extension from Haileybury to New Liskeard and a freight spur to the Haileybury wharf. The total length of the extension is 5.75 miles and the spur to the wharf is .81 miles long. The contract for line material has been let but the order for sub-station equipment has not yet been placed.

The Montreal Board of Control has declined to allow the Tramways Company to lay a T-shaped rail in the streets, the controllers favoring the old style. The ground of objection is that the new rail does not permit wagon wheels to go properly along the grooves of the rails, and hence the pavement is damaged.

The Moncton Tramways, Electricity and Gas Company have reached an understanding with the city as a result of which work on the extension of the street railway will be commenced in the near future. T rails will be used on the extension.

Mr. John Patterson who holds a charter for the construction of a line from Hamilton to Toronto which expires July 1st., 1912, still holds out hope that he will be able to complete arrangements with the International Board & Share Company and that work will be actually commenced before that date.

The Police Department of Hamilton has taken over the regulation of the street car traffic.

A by-law will be submitted in Calgary to expend \$88,000 on street railway extensions.

Industrial Progress and Trade Notes

Trade Publications

N. T. C. Bulletin—number nine, issued by the National Tube Company, of Pittsburg, contains information on Kewanee Unions.

Gould Telephone Batteries.—Booklet issued by the Gould Storage Battery Company, of 341-2 Fifth Avenue, New York City.

Synchronous Motors: A publication issued by the Westinghouse Electric & Manufacturing Company, regarding synchronous motors for power factor correction, by Nicholas Stahl. This article is a re-print in part from the Electrical Journal of October, 1911.

Bronze Products: A little booklet distributed by the Damascus Company, of Pittsburg, containing an illustrated description of their products. Some interesting information is given as to percentage composition of the different metals used in the alloys forming the Damascus products.

Portable Testing Outfit: Pamphlet issued by the Jewell Electrical Instrument Company, 810 West Lake Street, Chicago. This pamphlet describes a testing outfit small enough to be carried in the pocket which advantage is in no way at the expense of the accuracy or the durability of the instrument.

Midjet Meters.—A booklet descriptive of the Andrae Midjet meters, a small instrument manufactured by the Julius Andrae & Sons Company, of Milwaukee; also of the Jewell Pocket Testing Outfit. These pamphlets are issued by the Jewell Electrical Instruments Company, 810 West Lake street, Chicago.

Alternating Current Water Wheel Generators.—The Canadian Westinghouse Limited of Hamilton, Ont., have just issued circular number 1198 descriptive of their various types of alternating current generator machinery. The circular is well illustrated, among the illustrations being a number of well known Canadian and other plants.

P. & S. Bulletin: A short description of P. & S. electrical equipment, including sockets, receptacles, etc. Special prominence is given to the P. & S. ready-wired sign receptacles and porcelain sockets. A description is also included of the recent illumination of Cardinal Farley's New York Cathedral when some 50,000 8-c.p. lamps were utilized.

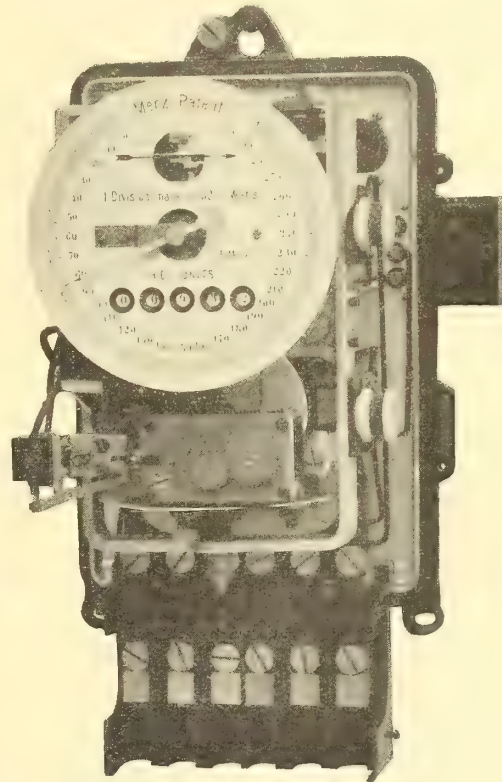
Pyrene.—The Ontario May-Oatway Fire Alarms Ltd., of 92 Adelaide street west, Toronto, have issued a catalogue describing the Pyrene chemical fire extinguishers. This extinguisher throws a continuous jet of Pyrene a distance of about 30 feet, discharging half an ounce at each impulse in either direction. A few strokes usually suffice to extinguish small fires and the remainder does not deteriorate. The extinguisher is unlocked and made ready for use by a quarter turn of the handle. It is strongly built of brass and white metal, is 3 in. x 14 in. in size and weighs only four pounds.

Kellogg Equipment: The Kellogg Switchboard & Supply Company have issued two four-page folders, one in English and one in Portuguese, descriptive of Kellogg moisture-proof cords. The booklet describes in some detail the method of manufacture and the tests to which cords are subjected. Also a second edition of the little booklet entitled "Things telephone users should know about telephone systems and service," an excellent treatise on modern advanced practice, especially as regards farm line service; also a second edition of "Some 1912 Acknowledgements of Unsurpassed Kellogg Service,"

Combined Kilowatt-Hour and Demand Meter

The Siemens Brothers Dynamo Works are placing on the Canadian market a meter which has been designed to enable power companies to charge consumers, particularly power consumers, on a load-factor basis. As will be seen from the illustration, there is a divided scale of 300° in addition to the ordinary kw.h. dials. Over this scale travels a pointer actuated through gearing direct from the rotor of the meter. The pointer indicates the highest load in watts averaged over any one of the standard time periods, viz., 5, 10, 15, 30 or 60 minutes.

The principle underlying the system is that it enables the power company to charge a fixed sum per kilowatt or per horse-power of the average load demanded, which fixed sum is sufficient to pay the interest charges of the capital

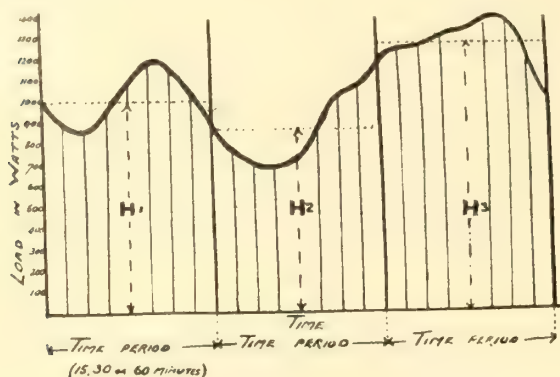


Combined Kw.H and Demand Meter

invested and to cover all annual establishment charges. The energy supplied can then be charged at a price per kw.h. which represents the generating cost plus a reasonable profit. Thus, the same price per kw.h. can be charged to all consumers, but the total sum they pay depends upon their relative load factors. The consumer with a better load factor obtains his energy at a lower rate per kw.h. actually than the consumer with the same consumption, but a higher average demand. It will be seen that this is very different to the Wright or maximum demand system, inasmuch as there is a definite and pre-determined time lag, and it is not the maximum amperes that are measured, but the true energy in watts demanded.

Owing to the relatively high cost of the apparatus for small consumers, it is not particularly advocated as a substitute for the ordinary meter for small consumers, and at present, therefore, its use is restricted to that class of con-

sumer who may be classed as a power consumer. The principle, however, can be applied to all consumers by dividing them into classes, and a figure taken which has been based upon a number of measurements actually made on such class of consumers. With regard to the periods chosen, the general rule, of course, is that those consumers who have approximately a fairly steady demand would be put upon a longer time rating, while that class of consumer with a more fluctuating type of demand is put upon the shorter time rating. The 15 minute rating is found to be a very convenient period for the general run of power



consumers. The line sketch shown will indicate in another way the use of this meter. The shaded portion of the diagram represents the consumption as shown on the dials in kw.h. The highest load in watts averaged over the chosen time period is shown by the demand pointer. Example; in diagram, H3 is the highest average load demanded, its value being indicated by the demand pointer.

Circulation Test of Robb-Brady Scotch Boiler

The Robb-Brady Scotch Boiler is a modified form of the standard Scotch marine boiler, the changes from the standard form being calculated to greatly increase the circulation. The heating surfaces are arranged as in the standard form and there are the same internal furnace flues, but there are two smaller shells, one above the other, in place of the large one and an annular circulating passage is formed at the front end by the use of a plate beneath the front neck. This plate guides the cooler feed water around the shell discharging it beneath the furnaces at the front. The water is heated while passing around the furnaces and among the tubes, and enters the steam drum by the rear neck.

The claims for positive circulation, made by the builders, were thoroughly tested a short time ago at the Sewerage Pumping Station, Framingham, Mass. The Robb-Brady boiler at this plant was equipped with thermometer oil wells so that the temperature could be noted at four points as follows:—at the top of the shell near the front end; at the top of the shell at the rear just over the combustion chamber and at the front and rear close to the bottom (See figure).

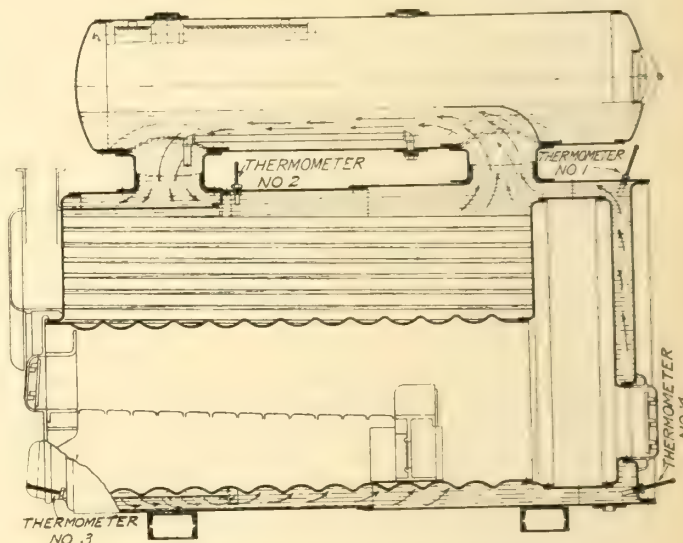
With water in the boiler at about 80 degrees the fires were started and readings of all thermometers taken every five minutes. As was expected, the temperature of the water at the top of the shell increased steadily until the boiling was reached. At the bottom, the temperatures increased very slowly up to the time the upper thermometer indicated the boiling point. Then the lower thermometer showed sudden rise and jumped to within a few degrees of those at the top. From this time on all four kept within a few degrees until 100 pounds was reached at which time practically no difference could be noted at the four points, showing conclusively that the circulation was positive and rapid.

How well this design fills the purpose is shown in the accompanying table which gives the thermometer readings at

Temperature Test—50 h.p. Boiler

Time	Ther. No. 1 Top rear end	Ther. No. 2 Top front end	Ther. No. 3 Bottom front end	Ther. No. 4 Bottom rear end
P.M.				
3.40	114 F	112° F	80 F	82° F
3.45	126	124	80	82
3.50	138	140	80	83
3.55	150	150	81	84
4.00	170	170	82	84
4.05	194	190	84	87
4.10	210	210	98	90
4.15	226	224	210	136
4.20	231	230	226	180
4.25	244	242	234	230
4.30	258	260	252	248
4.35	276	278	268	270
4.40	292	292	292	290
4.45	310	308	306	310
4.50	328	330	328	328
4.55	330	330	328	330
5.00	327	328	327	327

five minute intervals. The test proved that troubles due to poor circulation in marine boilers are a thing of the past; that positive circulation is easily obtained with the Robb-



Circulation Tests on Robb-Brady Boiler

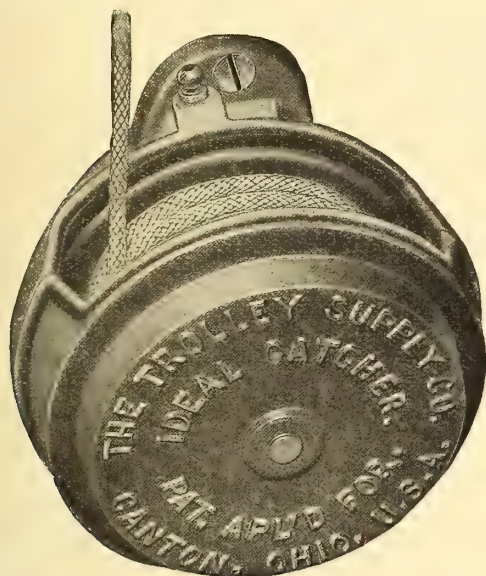
Brady device which forms an integral part of the boiler, not an external apparatus. The boiler is built under patents held by the Robb Engineering Company, Ltd., of South Framingham, Mass., and Amherst, N.S., Canada. The test was witnessed by many prominent consulting and operating engineers.

Thordarson Change of Address

Since April 25th the office and factory of the Thordarson Electric Manufacturing Company is situated at 501-515 S. Jefferson street, corner of Congress street, Chicago. Few concerns have shown more rapid strides than the Thordarson Electric Company since their incorporation in 1896. They have created a deserved reputation for excellent electrical apparatus. Their new quarters will afford much larger and better manufacturing facilities and more available space to carry a larger stock, also a conveniently arranged display room in which their complete line of commercial and laboratory specialties will be displayed.

The Trolley Supply Company

The cut shown herewith shows the Ideal trolley catcher manufactured by the Trolley Supply Company, of Canton, Ohio, who manufacture roller bearing trolley bases, retrievers, catchers, headlights, etc. The feature that appeals to operating men, perhaps more than any other, is the simple construction and few parts of these devices. The Knutson No. 5 retriever and the Ideal trolley catcher each have the simple method of connecting the rope to the reel, which is done by simply tying a knot in the rope end and inserting it in the reel slot, which method of connection is not found in any other retriever or catcher manufactured. They also have a large opening at top and bottom of case



Ideal Trolley Catcher

which allows rain, snow or sleet to pass through freely; this feature has proved to be a great advantage during the winter months.

The Peerless No. 10 trolley base is claimed to have absolutely no friction in the up and down or sidewise motion. It is practically two bases in one, as there are two sets of bearings all round. This base is manufactured with a "shunt wire" to carry away the current from the roller bearings. The Star trolley base is not absolutely frictionless but is just as well constructed for city service as the Peerless No. 10 is for high speed interurban. Both the Peerless No. 10 and the Star require no oil or lubricant.

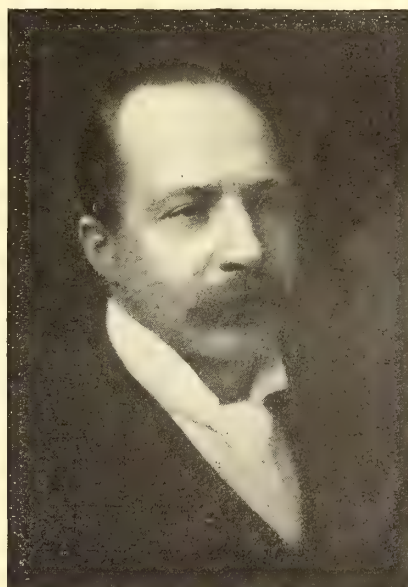
In the very near future this company will also place on the market a complete line of incandescent headlights, of both the counter-sunk type and the type to be bolted to the dash. The Peerless Jr. headlight which they placed on the market about a year ago is made in either combination arc and incandescent, or plain arc. It is very simple in construction, having about one-half the number of parts used in other lamps of this type, with a weight of only twenty-two pounds. Another device placed on the market within the last year is the Peerless check valve for air compressors, which absolutely prevents leakage of air from the tank back through the compressor, and also takes all back pressure from the compressor after it has been pumped to its capacity. With this valve installed in the main air line, placed as close to the tank as possible, it takes about three times as long for the compressor to go back to sixty pounds after being pumped to its capacity, as it does without the valve in use, thus proving conclusively that 75 per cent. of air leakage is back through the cylinder. Thus the use of this check valve means a large saving to the air equipment.

Canadian Union Electric Company

Early in 1910 Mr. Justus Eck, M.I.E.E., visited the eastern parts of the Dominion and came to the conclusion that Canada offered good opportunities for the disposal of the electrical goods in which he has for many years specialized in the United Kingdom. The result of this pioneer visit has been the establishment, in the fall of 1911, of the Canadian Union Electric Company, Limited, with headquarters at 9 St. Nicholas street, Montreal, with Mr. Eck as president, and Mr. Allan B. Wearing as vice-president. The embodiment of the name Union Electric is due to the considerable reputation Mr. Eck has earned in recent years as general manager and engineer-in-chief of the Union Electric Company of London, England, which in the short period of ten years has forced its name and products to the front in Great Britain and her colonies and dependencies south of the equator. The operations of the Canadian Union Electric Company will be confined to the technical lines comprising electrical power plants, controlling gear and arc lamp illumination.

Mr. Eck's experience has been gained from many lands—Italy, Switzerland, France, Germany, and South Africa. He claims to have been the first storage battery manufacturer in Italy, where the Dal Vermi theatre was entirely lit by accumulators of his make, delivering their current through underground mains of his own construction; he introduced the intense flame-arc lamp in the form of the Excella lamp to South Africa, where it is now used for lighting streets, mines, works and stores; the Ward Leonard rheostat and system of motor control was introduced by him into France and secured notable approval there.

In England Mr. Eck is known as one of the first members of the National Electrical Manufacturers' Association. He was also one of the founders of the Electrical Trades Benevolent Institution and is a member of the Council of



Mr. Justus Eck, M. I. E. E.

the Illuminating Engineering Society, to which body he recently presented a paper on the Illumination of Printing Works by Electricity, while his name has been on the books of the Institution of Electrical Engineers so far back as 1885. He is also the author of a book on Arc Lamps and is a frequent contributor to the electric technical journals.

Mr. Eck is a graduate of Cambridge (Peterhouse) University. He is spending the months of June and July in his company's interests in Canada.

Electric Trucks and Low Maintenance Charges

Automobile manufacturers, and especially the manufacturers of automobile tires, often state that the most deteriorating influence to which machines are subjected is an abnormally high speed. Speeding is an evil which can result only in decreased mileage for automobile parts and corresponding large maintenance expense. A particularly aggravating feature of this circumstance is that the matter of speed is not under the control of the owner unless he has a driver who obeys instructions implicitly, and uses precautions beyond the average. Reliable drivers may do this but there is always the fellow who, as soon as he is out of sight of the boss, throws open the throttle and burns up the pavement. With reference to the item of tires long demonstration has proved that with an average speed of twelve miles an hour the life of a tire is about twice what it is at an average speed of twenty miles an hour. Still higher speeds reduce the life of the tire proportionately. As a result the tire expense of a gasoline automobile or mistake to suppose that in the transportation of goods high speed has been one of the greatest obstacles to the advertisement and growth of the commercial motor vehicle industry.

This is just where the electric truck comes in. It is a mistake to suppose that in the transportation of goods high speed and power are essential. The electric truck geared for low or moderate speed delivers the goods equally as well and, at the same time, removes temptation from the unreliable employee. The electric truck has all the speed necessary and all the power, for momentary effort, that can be desired and, when it becomes a question of comparative cost of maintenance, appears to have an overwhelming advantage.

The Boston Electric Show

This big electric show, which will run from September 28th to October 26th this autumn, will occupy the entire Mechanics Building in Boston and is reported to be the most extensive undertaking of the kind that has ever been attempted, as the plans for decorations and provisions for the installation of a great variety of exhibits indicate that even the world's fair exposition will be surpassed in magnificence.

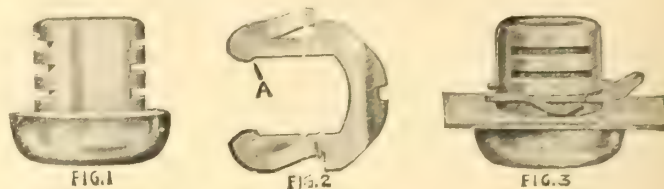
It is claimed that no electric display has ever had so much money expended on its promotion, development or management. It is under the auspices of the Edison Electric Illuminating Company of Boston, who have assumed the responsibility and in their desire to have everything first-class and educational rather than merely commercial, have set a very high standard. Preparations have been under way for over two years and definite work was commenced in September 1910. The number of employees have been steadily increasing and it is figured that more than a thousand men will finally be employed day and night completing the details so that everything can be ready for the opening on September 28th.

The company will have spent, all told, in the neighborhood of \$150,000. Special trains will be run from all directions. The show has been advertised extensively in foreign countries including electrical journals in Japan, England, France, Germany, Austria, Italy, Brazil and the Argentine Republic. Several exhibits have already been secured from these countries, the manufacturers evidently being sufficiently impressed with the possibilities of the enterprise that they are going to the expense of coming a great distance to exhibit their own products as well as to see others.

Porcelain Clamp Bushings

A new type of Porcelain Clamp Bushing is being patented and placed on the market by the American Bushing

Company, of Chicago, which they claim is simpler, superior and cheaper than anything now on the market. This clever little device consists of a vitrified porcelain bushing on the neck of which (diametrically opposite) are several slots or



indentations as shown in Fig. 1, and a copper plated steel clamp, Fig. 2, with spring arms which when placed in position in any of the slots (according to the thickness of the metal or other substance) at once forms an absolutely tight fastening which locks itself automatically. (See A. Fig. 2). Fig. 3 shows the bushing with clamp in place. The bushings are made in seven standard sizes, but can be made any special length and diameter to suit the occasion.

The H. W. Johns-Manville Co. Move to Larger Quarters

The executive offices and New York showrooms of the H. W. Johns-Manville Company, manufacturers of asbestos, magnesia and electrical supplies, were moved on April 20th to the new twelve-storey "H. W. Johns-Manville Building," Madison Avenue and 41st St., New York city, from their old quarters at 100 William street, where they have been located for the past 15 years. This move marks the 54th anniversary of the company. Under the name of H. W. Johns Manufacturing Company, the business was conducted at 87 Maiden Lane previous to May 1st, 1897, when it was moved to 100 William St. In 1901 the firm name was changed to H. W. Johns-Manville Co., a consolidation being effected between the Manville Covering Co., of Milwaukee, Wis., and H. W. Johns Mfg. Co. This last combination brought together two of the largest manufacturers of pipe and boiler coverings, packings, roofings, etc., in the world.

The growth of the company since that time has been steady. They now have factories located in Brooklyn, N.Y.; Milwaukee, Wis.; West Milwaukee, Wis.; Hartford, Conn.; Nashu, N.H.; Lockport, N.Y.; and Newark, N.J., with an asphalt refinery at South Amboy, N.J.; and extensive asbestos mines at Danville in the Province of Quebec, which are the largest in existence and produce an exceptionally fine grade of asbestos. They also have a branch house in every city of any size in Canada and the United States, as well as representatives in most foreign countries. In the new quarters, the company has the distinction of being one of the few manufacturing concerns which occupy an entire twelve-storey office building. In its entirety, the company now occupies over 2,657,160 square feet of floor space or about 61 acres. The employees number approximately 5,000 and there are about 425 salesmen.

New Manager for Marconi Wireless

Mr. J. H. Lauer has been appointed secretary and general manager of the Marconi Wireless Telegraph Company of Canada, resigning the secretary-treasureship of the Montreal Builders' Exchange to take up the new position. He is succeeded in this latter office by Mr. R. L. Werry, a member of the Montreal staff of the Hugh C. MacLean, Ltd. Mr. Lauer was secretary of the Builders' Exchange for seven years, and it is almost entirely due to his efforts that a practically moribund body has attained a leading position among similar associations in the Dominion. He is a good organizer as well as a capable speaker.

Wireless to Connect Old and New World

A direct wireless telegraphic service between the new world and the old, is to be established by the Marconi Company. This decision follows a definite working agreement just entered into between the Western Union, and Great Northwestern Telegraph Companies, and the Marconi Wireless System. The agreement provides that the Marconi Company shall have full benefit of the W. U. and G. N. W. Companies' land line stations for the receipt and delivery of their messages throughout the United States and Canada upon the most favorable cable rate terms. Under the new system messages may be filed at any W. U. or G. N. W. office addressed direct to the destination. Operation of the new plan will begin shortly.

The importance of the scheme lies in the fact that it warrants the wireless company in establishing the direct duplex service. At present there are two land relays and one wireless transmission of a marconigram from New York to London,—land line to Glace Bay, and relayed to Clifton Island, hence wireless, 2,300 miles to London, Eng. By the direct service, which is expected to be in operation in less than one year, messages will be transmitted without interruption from New York to London.

A number of long distance wireless stations are to be constructed at once near New York, which will provide direct communication with Cuba, Panama and South America, and in San Francisco for service to the Hawaiian Islands and the Philippines. Later a service to China and Japan is predicted.

Electrical Products Company

The Electrical Products Company, with office and show rooms in the Carlaw Building, Toronto, are winning recognition from the trade throughout the country by their wire-drawn metal filament lamp known as "Lion M." This lamp, manufactured by the well-known firm of Mix & Genest, Hamburg, Germany, is imported direct by the Electrical Products Company, who have the sole selling rights for Canada. Among many claims put forward for the superiority of this lamp is its unusual ruggedness. It is claimed it will burn at any angle and stand any amount of hard usage, being therefore, a most satisfactory type for office, store and factory use. The average life of the "Lion M." lamp is 1,500 hours with a current consumption of one watt per candle power. Besides this lamp the company also handles a German tungsten arc lamp and a general line of electrical accessories.

The man at the head of the Electrical Products Company, Mr. J. B. Neale, is an energetic, keen business man who every season makes a trip to Germany to keep in touch with the latest progress in lamps and electrical supplies. Under his able management the Electrical Products Company bids fair to become an important factor in Canadian electrical developments.

An Electric Industrial Truck

The General Vehicle Company of Long Island, N.Y., are placing on the market a small truck operated by storage batteries with a capacity of about 2,000 lbs. and which is designed for the rapid handling of free flowing bulk freight of all descriptions. The superiority of electricity as the motive power for such machines is now fully recognized and the absence of gas and smoke, danger from fire, etc., are important considerations. The operator rides on the truck, which moves at a speed about three times as great as he could push it when walking. He has perfect control over the truck, can steer it around corners or stop it instantly. He stands at the front end with one hand on the controller and a foot on the brake pedal. This type of control is in marked contrast to an operator pushing a

heavily loaded baggage truck along the ordinary crowded platform. The R. E. T. Pringle Company are the representatives for this truck in Canada.

Cook With Electricity

A booklet has just been issued by the Hughes Electric Heating Company, 226-228 West Superior street, Chicago, describing stoves, ranges, and heating devices manufactured by this firm. Prominent among these is the description of an electric range. The top of this range has four burners which consume electric current as follows: high heat, 880 watts per hour; medium heat, 440 watts per hour; low heat, 220 watts per hour. The heat for each burner is controlled by separate three-heat indicating switches conveniently located. The oven is elevated and contains two heating units. These are controlled by separate three-heat switches also. The oven is heavily insulated with asbestos so that food will bake a long time after the current is shut off. Current consumption of the oven unit same as above.

British Manufacturers Touring Canada

Electrical interests are strongly represented on the party of British manufacturers who arrive in Canada on June 6 for the purpose of touring the Dominion from coast to coast, and ascertaining opportunities for the establishment of branch factories, opening agencies, investment of capital, and generally extending the market for British productions. The party includes representatives of some of the best British firms, such as Electric and Ordnance Accessories, Ltd., Birmingham; General Electric Co., Ltd., London; Osram Lamps, Ltd., London; Robertson Electric Lamps, Ltd.; Peel-Conner Telephone Works, Ltd., Manchester; Aron Electrical Meter, Ltd., London; Malher and Platt, Ltd., Manchester; Indiarubber, Gutta Percha & Telegraph Works Co., Ltd., London; Hart Accumulator Co., London; Galloways, Ltd., Manchester; National Gas Engine Co., Ltd., Ashton-under-Lyne.

Medium and Slow Speed Alternators

Bruce Peebles & Co., Ltd., Engineers, Edinburgh, have just issued illustrated pamphlet No. 13B descriptive of Peebles medium and slow speed alternators. This new publication is very complete, giving ratings of standard 50 and 25 cycle machines for a range of speeds of from 1000 to 125 r.p.m. at pressures of from 200 to 6600 volts. In addition, rules are given for selecting the correct machine for other periodicities not listed. Very full lists of approximate weights and dimensions of alternators with excitors are also to be found in the pamphlet as well as a list of their more important customers, both at home and abroad, for machines of the type in question.

Canadian Tungsten Lamp Notes

Mr. W. H. Ginder, president and general manager of the Canadian Tungsten Lamp Company, was in Montreal recently on his semi-annual inspection of the Montreal branch. Among other contracts this lamp company have a three-year contract with the Montreal Light, Heat & Power Company for all their requirements for carbon lamps.

Mr. A. L. Woolf, Winnipeg manager, has just completed his trip over his eastern territory, which extends to Port Arthur. He reports business good.

Mr. F. Goodwyn, sales manager, was a visitor at Ottawa recently, on important business with the government. While there he secured accommodation at the Chateau Laurier for the C. E. A. Convention on June 19, 20 and 21, for himself and Mr. Ginder.

Westinghouse Publications

The Westinghouse Electric and Manufacturing Company have recently issued the following leaflets describing the various forms of apparatus mentioned:—2303—Direct-Current Crane Motors, detailed and completed views being shown; 2313—No. 907 Commutating Pole Mine Motors; 2314—No. 909 Commutating Pole Mine Motors; 2315—No. 910 Commutating Pole Mine Motors; 2464—Type HD Rheostats for d.c. Motors; 2377—Box Frame Interpole Railway Motor No. 308 B-2 for locomotive work; 2376—Box Frame Interpole Railway Motor No. 321 for use on 600-1200-volt service; 2370—Covers various details of railway motors such as bearings, brushholders, commutators, field coils, etc.; 2368—Strap Wound Armature Coils of Westinghouse Railway Motors. This leaflet contains a reprint from the Electric Railway Journal on the subject of "Square Wire or Strap Copper Construction;" 2444—Equalizer Fly Wheel Hoisting Sets. This leaflet shows application and diagrammatic views of these sets and full explanation of their method of operation. 2393—Covers Westinghouse Dynamo-motor Compressor for 1200-1500 Volt Direct-Current Service.

A New Ottawa Firm

Allen & Hitchcock is the name of a new electrical firm which have started business in Ottawa, with offices and showrooms at 377 Somerset street. Both H. L. Allen and M. J. Hitchcock are well known to the electrical trade around Ottawa. For over five years Mr. Allen has been the inspector of wiring in Ottawa for the Fire Underwriters' Association and during his tenure of office has given universal satisfaction and has been called upon to draft many specifications for inside installations which will now be one of the lines the new firm will specialize in. Mr. Hitchcock has had a wide experience in the United States and has specialized in telephone underground conduit work.

Marchand & Donnelly

Of the electrical firms doing business in Ottawa, probably one of the best known is that of Marchand & Donnelly, established there since 1897. Each year has seen a marked expansion in business, and during the past season they have secured contracts for the electrical work of some of the largest buildings which are being erected in the Capital city. Besides their business as general electrical contractors the firm maintain spacious showrooms at 128½ Sparks street where a full line of electrical supplies, motors and generators, electric lighting fixtures and shades, automobile and gasoline launch supplies are kept on hand.

A New Circular

The Holland Trolley Supply Company of Cleveland, manufacturers of trolley bases, harps and wheels and general electric railway equipment have just issued a circular descriptive of their Pneumatic Car Fender and Whitaker Air Sander and Trap which they are just putting on the market. It is claimed for the sander that it will not clog, that it is an absolutely reliable and new design and that it can be used in any position. The fender is operated automatically by any object striking it. The same automatic action sets the air-brake, sands the track and brings the car to a quick stop. Both circulars are well illustrated.

Escher Wyss & Company moved to Montreal

The head office for Canada of the Escher Wyss & Company, manufacturers of water turbines and accessories, Zurich, Switzerland, have sent out notice of their change of address from 408 Lumsden Building, Toronto, to 514-515 Canadian Express Building, Montreal, dating from May 15,

1912. The Escher Wyss & Company manufacture turbines, impulse wheels, centrifugal pumps, Zoelly steam turbines, paper and pulp machinery, air compressors, refrigerator machinery, etc. Mr. C. L. Trimmingham, Winnipeg, is agent for Manitoba, Saskatchewan and Alberta, and Frank Darling & Company, of Vancouver, is British Columbia agent.

As, however, the business connections of Escher Wyss & Company in the Province of Ontario are very numerous and prospects for future business are bright, they have appointed Mr. K. Printz, engineer, of 127 Delaware avenue, Toronto—formerly of John Inglis & Company, Toronto—their representative for the Province of Ontario.

Type T Turbo-Generator

The Westinghouse type T direct-current turbo-generator, consisting of a Westinghouse steam turbine direct connected to, and mounted on, a common base with a direct-current generator, is fully described and illustrated in Descriptive Leaflet 2458, just issued by the Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa. A full description of the various characteristics and construction details of the turbine is given, and numerous views of the component parts of the various elements, the completed machines, and installations are shown.

Water Powers at Auction

The Department of Lands and Forests of the Province of Quebec have distributed a circular notifying the public that the leasing of water powers previously advertised to take place on the 14th of May has been postponed to the 26th of June. These water powers were listed in the Electrical News of January, 1912.

The Regina Engineering Society is starting a catalogue file for the use of its members and are open to receive catalogues and trade publications. These will be placed where members of the society shall have ready access to them.

The Canadian British Insulated Company, Limited, Montreal, have obtained a contract from the city of Calgary for supplying and installing three miles of 3 conductor 12000 volt cable and two miles of 2 conductor 6000 volt cable.

The Victor Electric Company, Limited, has been incorporated with a capital of \$20,000, to manufacture electric lamps, appliances, etc., with head office at Guelph, Ont. The provisional directors are A. H. Macdonald, Albert Wicks, both of Guelph, and Alex. A. Rose, of Berlin.

Electrical Contractors Supply Corporation Limited has been incorporated with a capital of \$40,000 to carry on a general business as electricians and mechanical engineers, with head office at Toronto. The provisional directors are W. C. McNaught and C. F. Ritchie of Toronto.

The Union Electric and Contracting Company, Limited, has been incorporated with a capital of \$150,000, to carry on a general electrical and electric railway supply business with head office at Toronto. The provisional directors are A. Moore, C. A. Lewis and H. C. French, all of Toronto.

Plastics, Limited, of Toronto, have appointed the General Supply Company of Canada, Limited, Ottawa, sales agents for Manitoba, Alberta and Saskatchewan for Bakelite valve discs and pump valves. This business will be handled from the Winnipeg branch. Bakelite valve discs and pump valves have won quick recognition from the trade and are said to be in heavy demand.

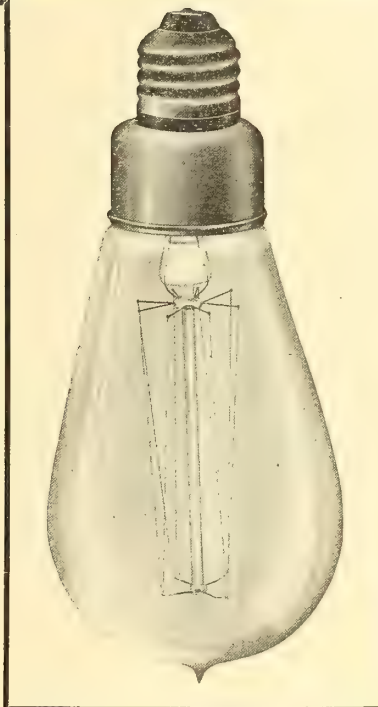
REASONS WHY YOU SHOULD BUY Drawn Wire Filament Mazda Lamps

Good Illumination Means:

Increased factory or
office efficiency.

Fewer production
delays.

Rapid repair work.



The Mazda Lamp

is the most perfect
illuminant yet
marketed.

It possesses the high-
est degree of effi-
ciency, brilliancy
and ruggedness.

The trade name "*Mazda*" represents the highest standard of quality in metal filament lamps, and is the only lamp in which the Drawn Wire Tungsten Filament is authorized to be used.

Any further improvements which may be made in the manufacture of metal filament lamps will be found in the Mazda lamp.

The drawn wire filament is unqualifiedly the most notable improvement thus far, making the Mazda lamp superior to any other metal filament lamp manufactured.

The Mazda Lamp is fully protected by Canadian Letters Patent and can be obtained from the

Canadian General Electric Co., Limited

Toronto Montreal Halifax Ottawa Cobalt South Porcupine Winnipeg
Calgary Vancouver Nelson Prince Rupert

Current News and Notes

Alliston, Ont.

Plans have been discussed looking to the purchase of the local electric light distribution plant and its utilization as an auxiliary in connection with a small water power which it is proposed to develop on the Boyne river.

Acton, Ont.

It is reported that the work of construction on transmission lines to supply Acton with light and power will be commenced immediately by the Hydro-electric Power Commission and will be ready for operation by September 1st. The price at which power is expected to be available is \$36 per h.p.

Barrie, Ont.

This town passed a by-law on June 3rd, authorizing council to close a contract with the Hydro-electric Power Commission for a supply of power to be brought from the plant of the Simcoe Railway & Power Company at Severn River. Coldwater submits a similar by-law on the 7th of June. Stayner, Collingwood and Elmvalle will also be supplied from the same line.

Brantford, Ont.

It has been announced that the by-law re an agreement with the Ontario Hydro Commission will not be submitted before January.

Brandon, Man.

The franchise of the Brandon Electric Light Company has been extended for five years.

It has been finally decided to install a municipal street railway system and a competent constructing engineer will be advertised for.

Collingwood, Ont.

Mr. E. J. Stapleton, of St. Marys, is the new town electrician, succeeding Mr. D. O. Streb, resigned.

The Hydro-electric Power Commission has quoted this town a price of \$33.97 per h.p. on condition that the town take 700 h.p.

Fort Frances, Ont.

The by-law fixing the rate of assessment of the Ontario and Minnesota Power Company at \$25,000 for a period of ten years, carried by a large majority. President Bachus states for the company that 500 or 600 men will commence work early in the season on the construction of a 120-ton paper and pulp mill which will cost \$1,500,000, and will employ about 500 men the year round. By this means the power company will be able to utilize on the Canadian side one-half of the total power development, as required by the Canadian Government.

The department of Public Works has ordered an investigation by Departmental engineers into the water power situation along the Rainy River.

Fort William, Ont.

The Fort William Coal Dock Co. has awarded the Canadian Westinghouse Co. contract for three motors.

Galt, Ont.

The report of the first eleven months operation of the hydro-electric depart-

ment shows a net profit of \$7,500 after operating expenses, sinking fund and interest on \$91,000 debentures have been paid; \$45,000, it is estimated, will be required to complete the system.

On June 29th a by-law to raise \$45,000 for extensions of the Hydro-electric power system will be voted on.

Rates have been reduced to lighting customers. The flat rate of 10c. per kw.h. now becomes 7½c. and the measured rate of 4c. per 100 sq. ft. plus 4c. per kw.h. is reduced to 3c. in each case.

Kingston, Ont.

The Kingston Milling Co. has made an offer to the Civic Utilities Commission to supply the city with a certain quantity of electric power which the private company proposes to develop at Kingston Mills. The company state that they will be in a position to supply power on November 30th, 1912, and will have available 150 kilowatts with peak loads of 300 kilowatts.

Manager Folger has closed a contract with the North American Smelting Co. by which the company agrees to take about \$1,500 worth of power from the city per year.

Lake Megantic, Que.

The council is asking the Provincial Government to grant this town full rights to water powers on the Chaudiere, which would be used for power and lighting purposes.

London, Ont.

An offer of \$50 per share has been accepted by the shareholders of the London Electric Company.

The Street Railway Company will purchase six new cars of approved type. Contracts for the new power building and machinery have not been let, pending further negotiations with the city having in view the use of Niagara power.

The London & Lake Erie Transportation Company have awarded the contract for the erection of their new car barns to George A. Ponsford. The new barns will be a one-storey building, of brick, 210 x 91 ft., with other details as described in the May Electrical News.

There is a movement on foot to build an electric railway connecting London and Port Burwell passing through Belmont and Aylmer. The length of the road would be 26 miles and the estimated cost \$20,000 a mile. The road could enter the city of London over the city's own line. the London and Port Stanley.

Meaford, Ont.

Negotiations have been carried on looking to the purchase of the plant of the Georgian Bay Milling and Power Company of this town. This company has been supplying the town with light and power, but recently met with an accident which left the homes and streets of Meaford in darkness.

Moncton, N.B.

The Moncton Tramways, Electricity and Gas Company's statement of the gross earnings from both the electricity and gas for the quarter ending March

26th, 1912, shows electricity \$14,495, gas \$1,880.

Merritton, B.C.

A by-law was recently passed to expend \$20,000 on the installation of an electric light plant.

Medicine Hat, Alta.

On June 3rd a by-law authorizing an expenditure of \$60,000 on electric light extensions was passed.

Minnedosa, Man.

Tenders have been received by the Minnedosa Power Co. for the following construction: Spillway, intake, penstocks and power house foundations.

North Toronto, Ont.

The Toronto & York Radial Railway Company is negotiating with North Toronto for a franchise extension and makes the following liberal offer: \$800 per annum per mile rental; 8 tickets for 25c. from 6 a.m. to midnight; 10 tickets for 25c. from 6 to 8 a.m., and 5 to 7 p.m.; freight to be handled between 10 p.m. and 6 a.m.; 5 minute service between 6.30 and 9 a.m., and 4.30 to 7.30 p.m.

The finance committee have recommended that the ratepayers vote immediately on the question of double tracking Yonge street. The Metropolitan Railway has offered some further inducements.

New Westminster, B.C.

The Western Canada Power Company are making a survey from Port Moody to New Westminster for the purpose of locating a line along which an electric railway may be built by this company.

North Bay, Ont.

A by-law will be submitted asking the opinion of the ratepayers regarding the closing of a contract with the Hydro-electric Power Commission of Ontario for the supply of power to this town.

Niagara Falls, Ont.

A delegation recently approached the Queen Victoria Niagara Falls Park Commission with a proposition to build an electric road along a right-of-way to be secured from the Park Commissioners paralleling the river bank from Fort Erie to Niagara-on-the-lake.

Nelson, B.C.

It is proposed to install ornamental electric standards along the main streets, the same to be paid for on the local improvement plan.

Orangeville, Ont.

The offer of \$46,000 made by Mr. J. M. Kilborne, of Owen Sound, for the assets of the Dufferin Light & Power Company, has been accepted. It is the present intention to put more money into the enterprise in an endeavor to place it on an earning basis.

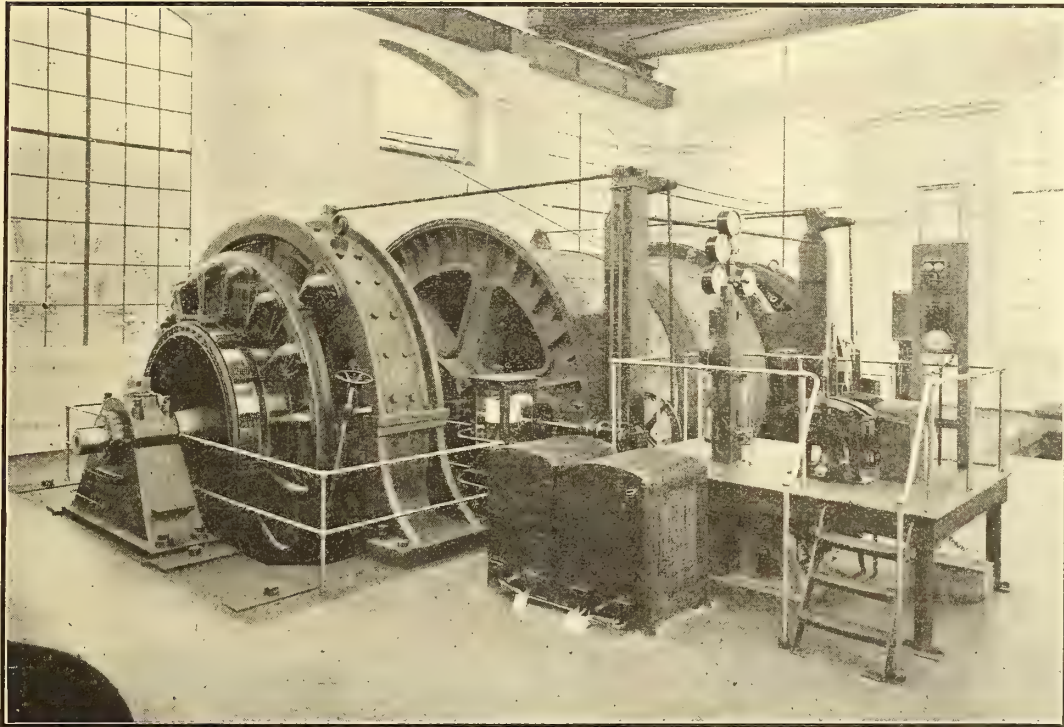
The Dufferin Light & Power Company have let the contract for the completion of their dam to Messrs. Cole & Gayson.

Ottawa, Ont.

The by-law authorizing the expenditure of \$70,000 for electric light extensions carried.

Work has been commenced on the

SIEMENS



SIEMENS-ILGNER ELECTRIC HOISTING ENGINE

Output 360 tons of Coal per hour from a depth of 2200 feet. Two complete plants have been installed and running at the Powell Duffryn Steam Coal Company, Pengham Colliery, South Wales. The peak load is 4,850 h.p. on the hoisting engine, and the balanced constant load on the converter set is 1,850 h.p. We have supplied or on order for Canada the following hoisting engines:—

- 1—1000 H.P. Hoisting Engine and Converter Set for the Dominion Coal Company, Nova Scotia
- 1— 400 H.P. Hoisting Engine and Converter Set for the Dominion Coal Company, Nova Scotia
- 2— 320 H.P. Hoisting Engines for the Acadia Coal Company, Nova Scotia.

Further information will be gladly furnished on request, and schemes prepared showing the economy of electric drive over steam winding.

(The mechanical parts of the above Hoisting Engine supplied by Fraser & Chalmers, London, England)

Siemens Brothers Dynamo Works Limited

London, England

Paris

Berlin

St. Petersburg

Vienna

New York

Head Office for Canada

10 Adelaide Street East, TORONTO

Branch Office: 707 McArthur Building, WINNIPEG

laying of temporary tracks for the street railway extensions along Wellington street.

Porcupine, Ont.

It is stated that E. A. Walberg's interests in the Wawatian Falls Power Co. have been acquired by Toronto and Montreal people.

On May 20th by-laws were carried as follows: To provide iron poles for the street railway and make other improvements to the railway; to lay heavy steel rails on the Fort William road; to extend and improve the electric lighting system.

Port Dalhousie, Ont.

The ratepayers on May 6th carried a by-law to raise the sum of \$10,000 for extensions to the electric lighting system recently purchased from the Maple Leaf Rubber Company.

Quebec, Que.

Tenders have been received by the Dorchester Electric Co. for two 1,000 kw. turbo-generators; transformers, arc and incandescent lamps will be called for later.

Ridgetown, Ont.

A by-law will be submitted on June 10th to the ratepayers calling for the raising of \$10,500 re purchase of the MacKow electric lighting plant.

Regina, Sask.

The following telephone companies have been recently incorporated: The Luton Rural Telephone Company; the Aberdeen South-Eastern Rural Telephone Company; the Poplar Grove Rural Telephone Company; and the Govan Telephone Company. The Dominion Odic Electric Company, Limited, has also been incorporated.

The following telephone companies have been incorporated recently in the Province of Saskatchewan: — Carron Rural Telephone Company, Boder Rural Telephone Company, North Star Rural Telephone Company, Union Rural Telephone Co., Wheat Plains Rural Telephone Company, Elim Rural Telephone Company, Simpson West Rural Telephone Company, and Arm Rural Telephone Company.

It is said that a Hydro-electric Commission similar to that in Ontario will be appointed by the Scott Government to take charge of important hydro-electric developments which are under discussion. It is planned to dam the south Saskatchewan River and divert a large portion of its waters to Moose Jaw, Regina and other places in the province. It is believed that in connection with the same scheme, large quantities of electric power can be developed.

Saskatoon, Sask.

On May 28th the telephone service in this city was put completely out of commission by fire which destroyed a portion of the automatic apparatus. It is reported that the delay will be only temporary.

An estimate recently made by the Stone & Webster Corporation on the supply of power available on the South Saskatchewan, a few miles below the city of Saskatoon, names 14,000 h.p. as being available at a total construction cost of slightly over two million dollars.

After allowing for interest on debentures, a depreciation of \$3,000, and a sinking fund of \$2,300, a net profit of

\$2,450 is shown by the quarterly statement of the city's electrical department just issued. This is in the face of a reduction of 25 per cent. in power rates, 22 per cent. in lighting rates and the abolition of meter rentals.

Following the report of the Stone & Webster Corporation that the cost of an hydro-electric development on the Saskatchewan river would approximate \$2,200,000, the private company which had an agreement with the city to supply power at \$33 per h.p. has withdrawn from the field. The street railway project which was being handled by the same company has also been dropped. It looks as if Saskatoon would now have a municipal street railway system.

A by-law asking \$80,000 for extensions to the electric lighting system, will be submitted.

Stratford, Ont.

The council has agreed to the C.N.R. contention that they be allowed to obtain power from any source they wish and it is believed construction work will be begun on the street railway system in the near future.

St. Catharines, Ont.

Contemplated extension to railway line. Owner, The Niagara, St. Catharines & Toronto Railway. Company are negotiating with the city for extension of their line to Niagara-on-the-lake from St. Catharines via Niagara street and Lake Road.

St. Thomas, Ont.

The London and Lake Erie Transportation Company have contracted with the Hydro-electric Power Commission of Ontario for power for their entire line from London to Port Stanley. Niagara power is already in use on one section of the line.

A citizen of St. Thomas has brought an action before Chancellor Boyd in the Assize Court to prevent the London and Lake Erie Railway and Transportation Company from operating its electric cars on Sunday. The objection is based on a section in the Ontario Railway Act, but the company claim that they are incorporated under a Dominion charter.

On May 13th, a by-law was voted on to expend \$23,500 on street railway extensions.

The Canadian Boving Co. are installing a centrifugal pump, capacity 3,000,000 gals. in 24 hours, electrically driven by a 60 B.h.p. Lancashire motor, 2200 volts, and a centrifugal pump, capacity 5,000,000 gals. in 24 hours, driven by an Alley & McLellan 100 h.p. engine.

Taber, Alta.

A private company has approached the town council with a suggestion to install an electric plant capable of furnishing the town with lighting and power on a 24 hour service. A 20-year franchise is asked.

Vancouver, B.C.

The Portage Creek Power & Light Company has been incorporated with head office in Vancouver.

The B. C. Electric Railway Company has awarded the contract for the construction of another steam auxiliary plant at Saanich Inlet at a calculated cost of \$400,000. Messrs. C. C. Moore

& Company have the contract. The generating equipment will consist of two 2,000 kw. Allis-Chalmers-Bullock turbo generators. A smoke stack of reinforced concrete and 248 ft. high, with an inside diameter of 11 ft. at the top and 18 ft. 7 in. at the base, will form part of the equipment.

It is understood the International Power and Mfg. Co. will begin construction work this summer on a generating plant on the Pond D'Oreille River situated near the international line in the northwestern corner of Washington territory. It is calculated that 100,000 h.p. can be developed here.

Mr. W. T. Woodroffe, for a number of years with the British Columbia Electric Railway Company, and latterly City Electrician of Vancouver, has been appointed superintendent of the street railway department in Edmonton.

Vermillion, Alta.

A by-law to expend \$1,000 on street lighting extensions was passed on May 3rd.

Winnipeg, Man.

The City of Winnipeg has ordered an electric locomotive to cost \$7,938, from the Ottawa Car Company.

No objection was raised in council to the passage of the by-law bringing the city electrical plant under the jurisdiction of the public utilities commission.

Walkerville, Ont.

R. F. Agnew, Walker Power Bldg., will install machinery for the manufacture of electric welding machines. A large quantity of electrical supplies will be purchased.

Notice to Users of Incandescent Lamps

Patents on Tungsten Incandescent Lamps having been issued to us, we hereby warn the public against the use of infringing lamps, and advise them that "MAZDA" Drawn Wire Tungsten Lamps, manufactured in Canada under aforesaid patents, can be procured from this Company at its Head Office and all branch Offices, or from our Licensees, The Canadian Sunbeam Lamp Company.

The Colloidal Tungsten Filament Lamp, manufactured under the Kuzel Patents, can be procured from our licensees, The Canadian Tungsten Lamp Company.

Canadian General Electric Company, Limited

212 King St. West

Toronto, Canada

New WESTON INSTRUMENTS

A Full Line of Alternating Current Switchboard Indicating Instruments

is offered by this Company, comprising:

WATTMETERS, Single and Polyphase.

POWER FACTOR METERS.

SYNCHROSCOPES.

FREQUENCY METERS.

VOLTMETERS.

AMMETERS.

and New Models of Weston D.C. Instruments to match

This whole group of instruments embodies the results of several years exhaustive study and scientific investigation of all the complex electrical and mechanical problems involved in the development of durable, reliable, sensitive and accurate instruments for use on alternating current circuits.

Every detail of each of these instruments has been most carefully studied and worked out so as to be sure that each shall fully meet the most exacting requirements of the service for which it is intended. Neither pains nor expense has been spared in the effort to produce instruments having the longest possible life, the best possible scale characteristics, combined with great accuracy under the most violent load fluctuations and also under the many other trying conditions met with in practical work. Every part of each instrument is made strictly to gauge and the design and workmanship and finish is of the highest order of excellence.

We invite the most critical examination of every detail of each member of the group. We also solicit the fullest investigation of the many other novel features and very valuable operative characteristics of these new instruments and request a careful comparison in all these respects with any other make of instrument intended for like service. We offer them as a valuable and permanent contribution to the art of electrical measurement. Their performance in service, will be found to justify the claim that no other makes of instruments approach them in fitness for the service required from A.C. Switchboard indicating instruments.

Full particulars of design, construction, prices etc., are given in Catalogue E. N. 16. Write for it.

WESTON ELECTRICAL INSTRUMENT CO.

Main Office and Works, Newark, N. J.

New York, 114 Liberty St.
Chicago, 1504 Monadnock Block.
Boston, 176 Federal St.
Philadelphia, 342 Mint Arcade.
Birmingham, Brown Marx Bldg.
Detroit, 44 Buhl Block.

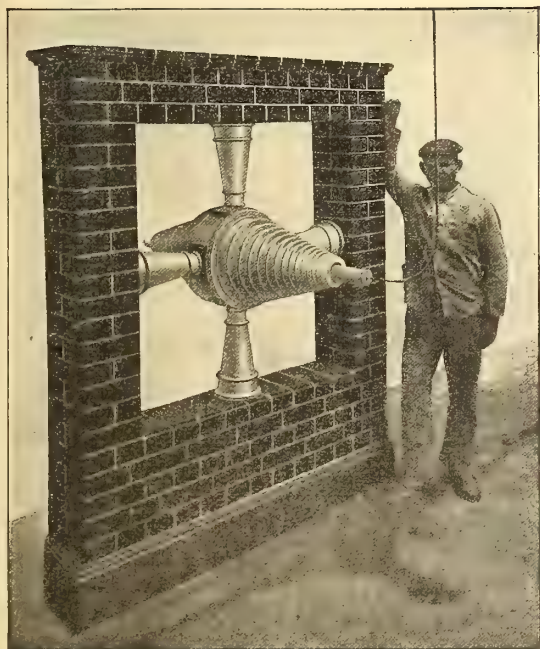
St. Louis, 975 Olive St.
Denver, 231—15th St.
San Francisco, 682 Mission St.
New Haven, 29 College St.
Cleveland, 1522 Prospect Ave.

Paris, 12 Rue St. Georges.
Berlin, Genest St. 5 Schoenberg.
Mexico, 2, a Capuchinas 40.
London, Audrey House. Ely Pl., Holborn

Toronto, 76 Bay Street.
Montreal } The Northern
Winnipeg } Electric &
Vancouver } Manufacturing
Calgary } Company

Porzellanfabrik Hermsdorf

Sachsen-Altenburg, Germany



Wall Duct for the High Tension
Transmission Station of the

**Hydro-Electric Power
Commission of Ontario**

110,000 Volts

Sole Agents for Canada

Watson Jack & Company

709 Power Building, MONTREAL

Condensed Department

RATE
Positions Wanted } 2 cents a word per inser-
Positions Vacant } tion.
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Tender advertisements, equipment for sale, etc., 15 cents per agate line (14 agate lines make one inch) per insertion.

Advertisers who wish to conceal their identity may do so by using an Electrical News box number without extra charge.

Forms close on the 18th of each month.

Situations Wanted

Position wanted by Electrician, as power house operator, used to A.C. and D.C. currents. Four and a half years experience. Age 22; single. Reply to Box 501, Electrical News, Toronto, Ont. 6

Position Wanted—Electrician with twelve years' experience in electrical work, Steam and Hydro plants, construction, operating and repairing, is open for engagements. Box 503, Electrical News, Toronto, Ont. 6

Electrician with large experience in transformer work, design, testing and building, motor installations, repair and trouble work, A. C. and D. C., is open for engagement and desires to hear from power companies and others; age 32. Apply Box 485, Electrical News, Toronto, Ont. F

Position Wanted

Gentleman, M. I. Mech. E. expert in design and construction of cranes and hoists, all types and sizes, electric, steam, hand; 20 years' practical experience in Britain, Germany, United States, seeks leading position with good firm. Reply Box 483, Electrical News, Toronto, Ont. F

Position Wanted

Electrical and mechanical training supervision of duct and pipe laying, cable installing, high and low tension underground distribution. Apply Box 484, Electrical News, Toronto, Ont. F

Manager Wanted

to manage The Saugeen Electric Light and Power Company's business at Southampton. Apply, stating qualifications and salary asked. References required. Saugeen Electric Light & Power Company, Ltd., Walkerton, Ont. F

Wanted Superintendent

Superintendent for the Electrical and Water Works Department in a town of 7,000, to take care of distributing system. Applicant must have full knowledge of all out door work, instal services and make repairs. State full particulars and salary required; duties to commence May 15th, 1912. Address Box 476, "Electrical News," Toronto, Ont. F

Situations Vacant

WANTED—Young electrician capable of testing, repairing, installing meters, etc. State experience, education, age, etc. Address Box 473, Electrical News, Toronto, Ont. 6

REPORTER

We want an energetic representative in each town in Canada to report on building and engineering work—to tell us where machinery, equipment, supplies or materials may be sold. Reports are paid for on the per item basis. It depends upon your own efforts how much you make. This is a profitable side line and there is good money in it for a hustler. Write to MacLean Daily Reports Limited, 220 King street west, Toronto.

Agency Wanted

Agency wanted for a good line by Toronto Sales organization. Reply Box 497, Electrical News, Toronto, Ont. 6

Articles For Sale

An improvement in Gas Lamps and Heaters as manufactured in Canada in conformance with Canadian Patent No. 121,252, can be obtained, and orders for the same will be received by Lloyd Blackmore & Co., 17 Elgin St., Ottawa, Canada. F

For Sale

Ayr electric light plant in first class condition, steam power, good service and contracts. Exclusive franchise in town of 1,200. A splendid chance for a practical man. Being sold because of owner's death. Apply D. M. Clark, 15 McKenzie Crescent, Toronto, Ont. 2-TF

Plant For Sale

Electric light plant and water power in Western Ontario, at present rented and in good running order. Also farm, on which plant is situated, suitable for grazing or cultivation. For further particulars apply to R. C. Pearce, Paisley, Ont., or D. McIntyre, 1943 Smith Street, Regina, Sask., proprietor. 3-6

For Sale

One only D.C. Generator, 25 h.p., 19 kw., 250 volts, 1100 r.p.m.

One only D.C. Motor, 15 h.p., 12 kw., 250 volts, 110 r.p.m.

Both in first-class condition. Will sell at sacrifice to ensure a quick sale. Apply at once to the Gold Medal Furniture Mfg. Co., Limited, VanHorne & Bartlett streets, Toronto. 6

CITY OF VERNON, B. C.

Tenders, in duplicate, for Electrical Equipment, will be received by D. C. Tate, City Clerk, up to three o'clock p.m., June 10th, 1912, for the delivery F.O.B. Vernon, B.C., of the following:

1—125 K.W., Three-Phase, Sixty Cycle Generator.

1—Exciter, direct connected to above.

1—Five Panel Switchboard.

1—Series Tungsten, or

1—Arc Lighting System.

Specifications will be on file at the following offices: Canadian Electrical News, Toronto; Contract Record, Toronto; Canadian Engineer, Montreal and Winnipeg, and Mather Yuill & Company, Limited, Consulting Engineers, Vancouver, B. C. 6

Opportunity

With the great protection of duty afforded Canadian manufacturers of electrical goods, coupled with the fact that there are practically no switchboards or panel boards made in Canada, most of this material now being imported, we are in position to offer a wide-awake man the chance of a life time. We are electrical contractors in the States, and have also carried on the manufacturing of panel boards, metering boards and cabinets, but owing to the conflicting nature of the two, we have decided to abandon the manufacturing business. We, therefore, offer for sale our entire plant, consisting of machinery, dies, tools, copper, slate, raw, semi-finished and finished material, templates, cost records, drawings, cuts for catalogues, etc. We will dispose of this as a whole at a sacrifice and on a cash basis.

Apply Box 505, Electrical News, Toronto, Ont. 6-8

Electrical Books

A number of Electrical Books are offered for sale at about one-half their cost. They embrace a large number of subjects, such as Notes on Electro-Chemistry; Practical Alternating Currents and Power Transmission; Elementary Principles of Continuous Current Dynamo Designs; Standard Polyphase Apparatus and Systems; Stray Currents from Electric Railways; Electric Lighting and Power Distribution; Transmission Calculations; Telephone Construction, Operation and Maintenance, etc.

These books may be seen at the office of the Electrical News, 220 King street west. Particulars regarding any book will be furnished on request.

ESTABLISHED 1849.

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THOS. C. IRVING.

Gen. Man. Western Canada, Toronto

Moonlight Schedule for June 1912

Courtesy of the National Carbon Company, Cleveland, Ohio.

Date.	Light.	Date.	Extinguish.	No. of Hours
June 1	7 50	June 1	11 00	3 10
2	7 50	2	11 50	4 00
3	7 50	3	0 30	4 40
4	7 50	4	1 00	5 10
5	7 50	5	1 30	5 40
6	7 50	6	1 50	6 00
7	7 50	7	2 10	6 20
8	7 50	8	2 30	6 40
9	7 50	9	2 50	7 00
10	8 00	10	3 10	7 10
11	8 00	11	3 40	7 40
12	8 00	12	3 40	7 40
13	8 00	13	3 40	7 40
14	8 00	14	3 40	7 40
15	8 00	15	3 40	7 40
16	8 00	16	3 40	7 40
17	8 00	17	3 40	7 40
18	8 00	18	3 40	7 40
19	8 00	19	3 40	7 40
20	10 20	20	3 40	5 20
21	10 50	21	3 40	4 50
22	11 10	22	3 40	4 30
23	11 30	23	3 40	4 10
24	0 00	24	3 40	3 40
25	0 30	25	3 40	3 10
26	1 00	26	3 40	2 40
27	1 50	27	3 50	2 00
28	No Light	28	No Light	
29	8 00	29	10 30	2 30
30		30		

Total 157 40

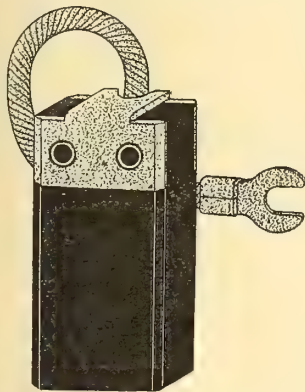
Power Equipment For Sale

- 2 Tandem compound Wheelock Engines, cylinders 21 in. and 38 in. by 46 in. stroke.
- 2 Fly-wheels 18 ft. diameter, 46 in. face.
- 2 Double Leather Belts, each 112 ft. long, 42 in. wide.
- 2 Tubular Water Heaters.
- 2 Northey Jet Condensers, cylinders 12 in. and 18 in. by 18 in. stroke.
- 1 5 in. Line Shaft, 15 ft. long, with friction coupling and pulley 4 ft. 11 in. by 46 in.
- 6 Fire Tube Boilers, each 63 in. diameter, 14 ft. long containing 84 three-inch tubes. Pressure allowed by Boiler Insurance Co., 110 lbs. per square inch.
- 2 Northey Feed Pumps, cylinders 5 in. and 8 in. by 12 in. stroke.

All the above steam and water connections in very good order. These engines were started in 1894, but were seldom used, being an Auxiliary Plant. Offers will be received for all or any of this plant. A great bargain for early buyer of part or whole plant.

The Ottawa Electric Company

35 Sparks Street, Ottawa, Ont.



**100 per cent
Carbon
Brush
Efficiency**

is invariably obtained
wherever LE VALLEY
VITAE BRUSHES are
intelligently used.

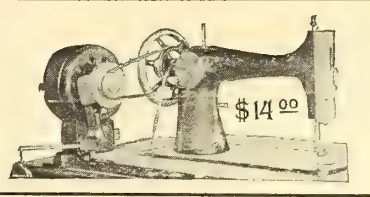
Vitae Brushes

REDUCE Commutator Repairs.
INCREASE Current Output.
SAVE Shut-down Losses.
Every Brush Sold under an absolute guarantee.
Money back if not satisfactory.
Why experiment.
A TRIAL ORDER will convince.
Samples gladly sent.

**Le Valley Vitae Carbon
Brush Company**

4123 Park Ave. - New York City

Household and Factory Sewing Machine Motors



Motor equipment will fit any make sewing machine. Costs only quarter cent per hour for current to operate it, in household size. Motor starts and stops automatically with treadle by means of a patented switch located in base. Speed of sewing machine is varied by the

pressure of the foot on the treadle. The simplest, the most durable, the cheapest to operate and last but not least, the cheapest in price.

Write for particulars and net prices.

Fidelity Electric Company, Lancaster, Pa., U. S. A.



On a Construction Tool

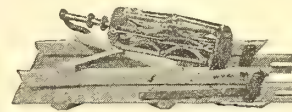
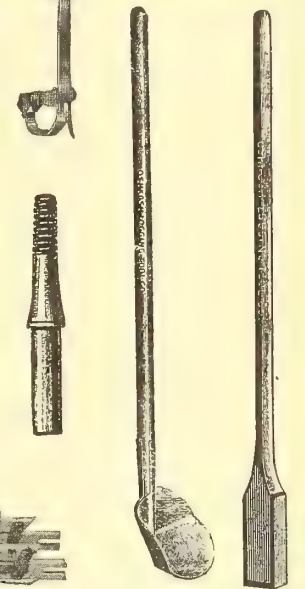
is the guarantee
of the highest
perfection that
modern facilities attain
in the manufacture of

Linemen's Tools

Our catalogue tells the
story. **Get one.** It
will help to solve the
Spring construction
riddle.

Oshkosh Mfg. Co.

South Main
Oshkosh Wisconsin



Tenders

A few dollars spent in advertising
your proposals in

The Contract Record

would result in additional competition,
which might save your city or town or
your client many hundreds of dollars.

Economy Renewable Cartridge Fuses

(NOW MADE IN CANADA)

Patents have been granted on the **Economy Renewable Fuses** for Canada and Great Britain.

In order to meet the demand and furnish direct to the Canadian trade The Economy Fuse and Manufacturing Company of Canada has been organized to manufacture these fuses in this country.

Economy Fuses are guaranteed to operate according to ratings, and meet specifications of the National Board of Fire Underwriters.

Can be easily and cheaply renewed without returning to the factory. No soldered connections. Will save 80% of annual fuse expense. The secret of success is in the link renewal.

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WE WOULD LIKE TO ESTABLISH A FEW EXCLUSIVE AGENCIES

Economy Fuse and Manufacturing Company of Canada

Bridgeburg, Ont.



BRUSH

P R O D U C T S

Brush Electric Motors

Are absolutely essential where you
have heavy work to do. We
carry a complete stock
in our building in
M o n t r e a l

Are you
familiar with
our detachable
OSCILLATING BASE
which permits of a Stationary
Fan being converted to an
Oscillating Fan. We carry these
bases in stock 16" and 12". Through
the adoption of same you can save consider-
able money which would otherwise be spent
in the purchase of Oscillating Fans.

Stuart, Drinkwater & Hingston
Limited

485 St. James Street, MONTREAL

Tungsten and Carbon Lamps

We are Headquarters for anything in Incandescent Lamps

TUNGSTEN

The "JUST" TUNGSTEN. One customer of ours reports that on 250 Tungsten Lamps, burning 2 M hours only eleven had to be replaced. Send for a trial dozen at case lot prices.

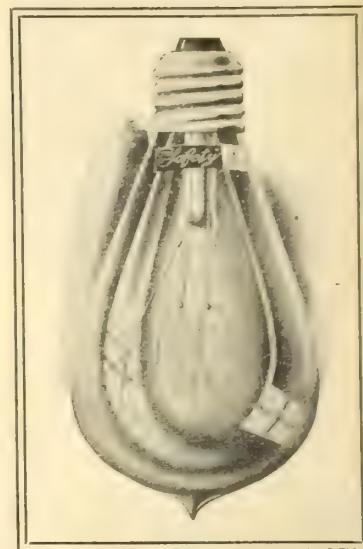
CARBON

A lamp that will meet class A specifications. Can furnish either 3.1, 3.5 or 4 watts per candle. Try an assorted lot at our case lot price 13 cents. This is certainly a splendid lamp.

OTHER SPECIALTIES

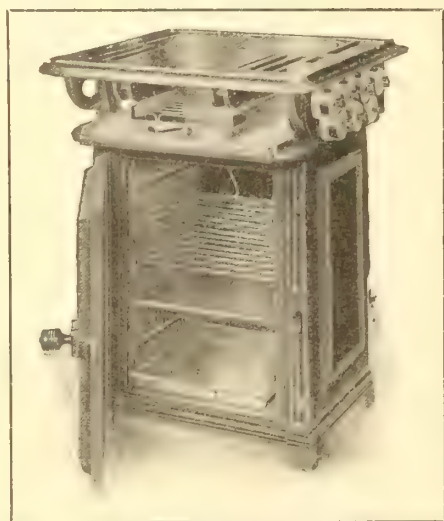
"Hot Point" Heating Appliances, "Brookduct" (Flexible Conduit) "Krakno" lighting glassware, New Code fuses, line material, Sign Transformers, Rectifiers, etc.

Be sure you write us to-day before you forget, if in a hurry phone at our expense.



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Domestic Cooker No. 639

ECLIPSE

Electric Heating and Cooking Utensils

The proved best appliances upon the British market.

Have been thoroughly tried out in actual use.

Are thoroughly reliable under usual kitchen conditions.

Highly efficient, well made and low in price.

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Steel Transmission Structures

"A" FRAME TOWERS

Substantial in Construction
Shipped Assembled and Rivetted
Easy to Handle and Erect
Great Saving in Maintenance
Continuous Service
Cost but little more than wood poles

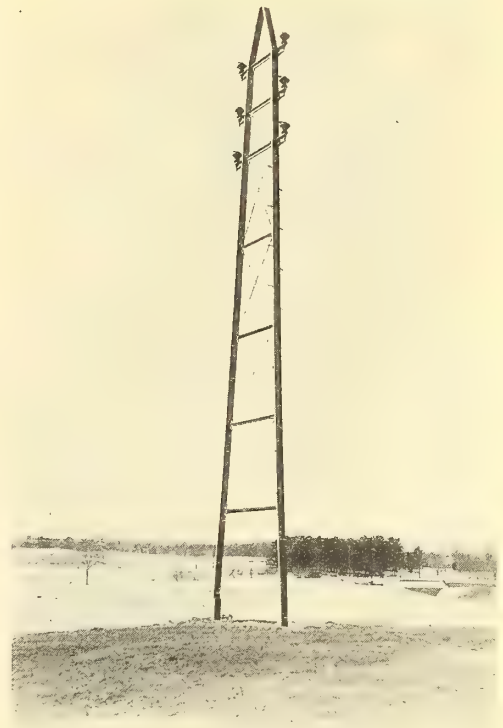
Minimum Field Labor



22,000 Volt Transmission Line
Fulton County Gas and Electric Co.
Gloversville, N.Y.

Special Towers

We make a specialty of long span crossings over rivers, railroads, etc. and structures carrying very heavy loads.



33,000 Volt Transmission Line
Berkshire Street Railway Co.
Pittsfield, Mass.

We are now building for the

Dominion Power and Transmission Co., Ltd.

the towers for their new 45,000 volt transmission line 34 miles long from the Welland Canal to Hamilton, Ont.

Towers will be like those shown in illustrations and are designed to carry 6 conductors No. 00 copper and ground wire on 400 foot spans.

Write for illustrated Catalog and estimates on your requirements

ARCHBOLD-BRADY CO.

Engineers and Contractors

SYRACUSE, N.Y.

Watch the Number of "Mirr- lees-Diesel" Installations Grow

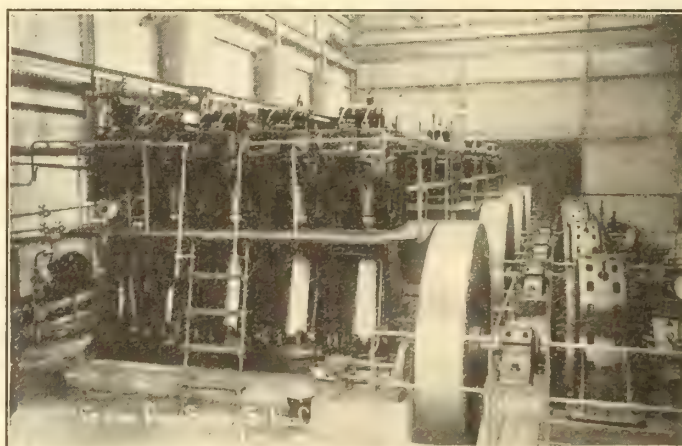
The Extraordinary Results Obtained
With This Prime Mover are Marvellous

The First Engine Introduced by us in Canada Late Last Year.
The Following are Now Either Running or on Order:

Moose Jaw Electric Railway Co.	-	2 Engines of 200 B.H.P.
"	"	" (Repeat) 1 Engine of 500 "
Town of Yorkton	- - - -	1 " 150 "
Town of Scott	- - - -	1 " 100 "
Town of Wilkie	- - - -	1 " 100 "
Town of Battleford	- - . -	2 Engines of 240 "
City of Vernon	- - - -	1 Engine of 200 "

Economy

No Stand-by
Losses



Reliability

Small Repair
Bills

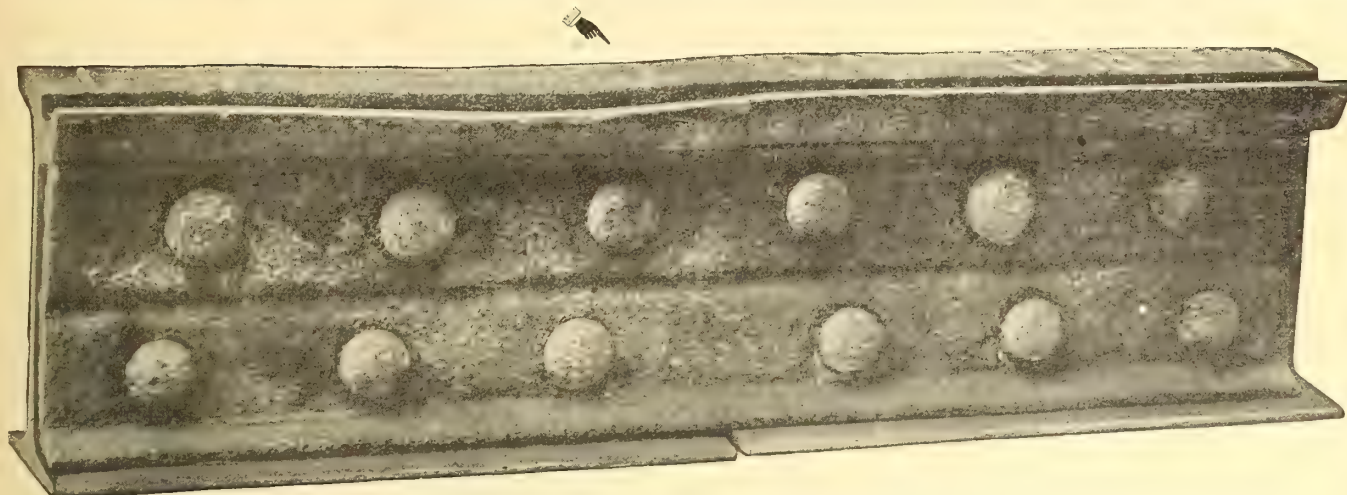
The Canadian Boving Company, Limited

164 Bay Street, - - Toronto

Vancouver Office: 448 Seymour Street

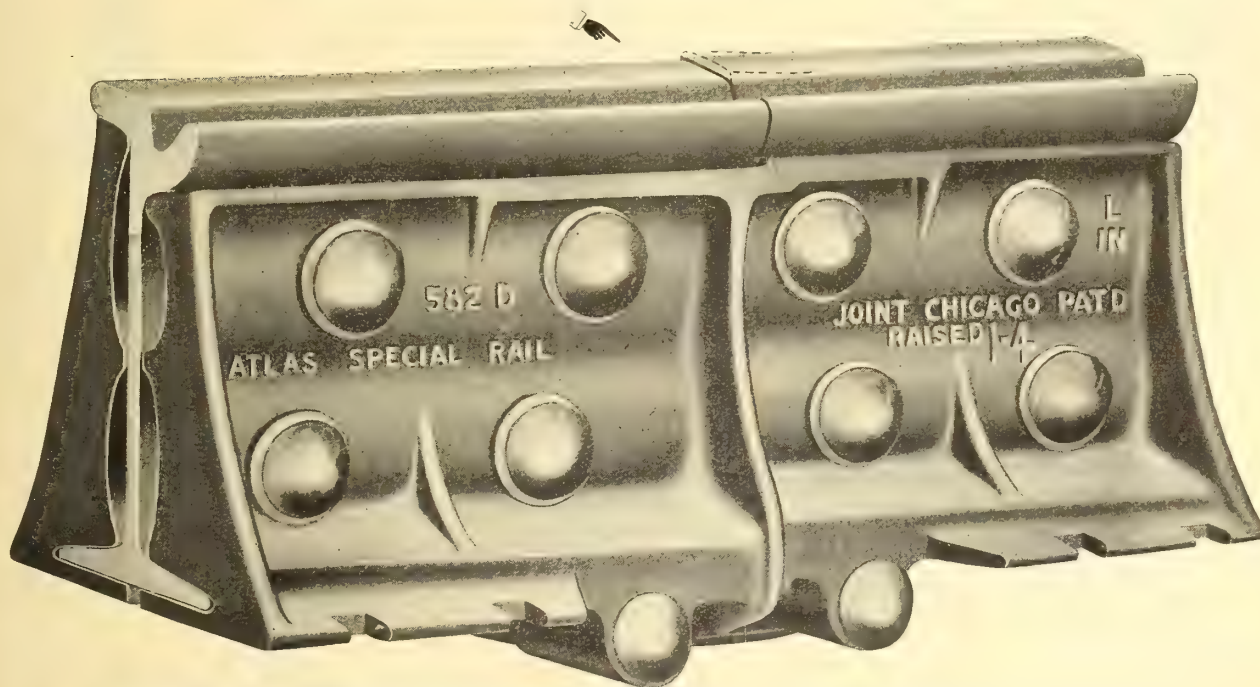
Have You Any Joints Like This?

Let Us SAVE Your Rails



Joint shown was sawed out of a piece of track for which we furnished SPECIAL JOINTS

Dotted Line shows the worn rail before the same is ground off



This shows the same rails after Atlas Special Joint is applied and the worn and raised rail is ground off

Made for any style rail, Tee, Girder or Groove, either suspended (as shown) or supported. Raising the worn rail whatever amount is necessary
Raises the worn rail to the level of the adjoining rail and holds it there. The rail is then ground even as shown
Ask for Circular 6112

ATLAS RAIL JOINTS—BRACES AND TIE PLATES
ATLAS ONE PIECE JOINTS, Use your old Splice Bar on Inside
 (For Old or Light Tee and Girder Rail)

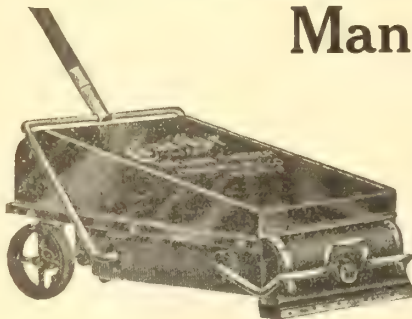
ATLAS RAILWAY SUPPLY CO. 1527 Manhattan Bldg., CHICAGO

A Money Maker for You

That's What You're in Business for EH!

MISTER

Electrical Retailer,
Hardware Retailer,
Manufacturers' Agent,
Power & Light Co's.



CADILLAC VACUUM SWEEPER

This One
No Electricity Required
Something New

A Chance to Increase Your Sales

Write Us for our
Proposition

It's a Good One



CADILLAC ELECTRIC CLEANER


This One
Cost One Half cent
Hour To Run

*If It's Something New You've Heard
About and Want to Get It TRY*

SAYER ELECTRIC

85-87 Bleury Street, MONTREAL

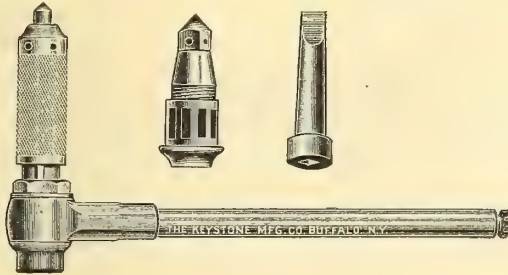
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(Annex Branch)

 Largest Stock in Canada of Electrical Novelties of All Kinds

Traction Companies, Emergency Waggon and Machine Shops are not completely fitted out unless equipped with our line of High Grade Tools, ————— Guaranteed

"KEYSTONE" Reversible Ratchet COMBINATION No. 200

Consists of Ratchet for Taper Shank Twist Drills, Sleeve for Square Shank Drills, and Short Boiler Socket for Square Shank Drills, (Sockets Interchangeable)



The "KEYSTONE" Wrench, Forged Steel



Polished All Over Except Web

The Original "WESTCOTT" All Forged Steel Adjustable "S" Wrench



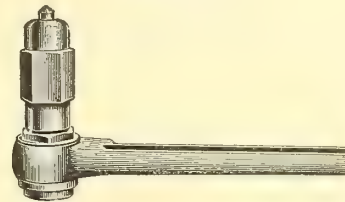
Interchangeable Jaw for Pipes also supplied with each if desired

The Original "WESTCOTT" Adjustable "S" Wrench



HANDLE MALLEABLE IRON, JAW FORGED STEEL
We also make a Pipe Wrench in this style

"GIANT" Railroad Track Ratchet (Single Acting)



Made with 24 inch Handle only, taking No. 2 SQUARE TAPER Shank Drills

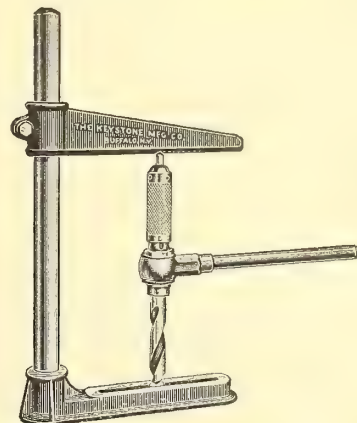
"GIANT" Ratchet Socket Wrench (Reversible)



24 inch Handle only
ALL SOCKETS TAKE SQUARE OR HEXAGON NUTS

"KEYSTONE" Drilling Post or "Old Man"

(For Use With Ratchet Drills)



Saves Many Hours of Valuable Time

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Largest Exclusive Electrical Supply House in Western Canada

We Cover NORTHERN ONTARIO,
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Advise us by post card and we will have
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All lines of standard electrical material car-
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TEOUS TREATMENT. If you are NOT
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S**S**



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High Efficiency

TRANSFORMERS



**The Best Value
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Low Core Loss

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Moloney Transformers are stocked in our warehouse in Winnipeg
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We are the AUTHORIZED REPRESENTATIVES for ONTARIO of the

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Exactly as we have always been

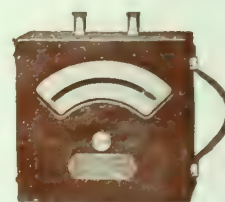
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Look into the merits of the

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Wire Drawn Tungsten Lamps

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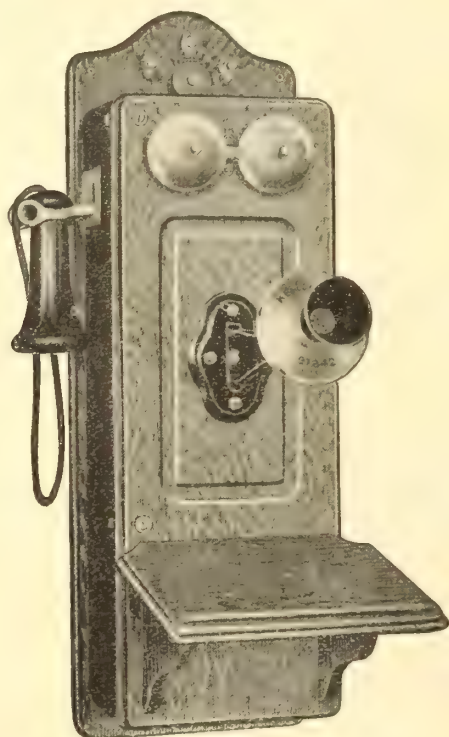
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In Long Service
Kellogg First Cost



To every farmer telephone man who will install one or more telephones this summer, we say:

If it's the heavy service magneto rural or farm line in which you are interested here is a telephone unequalled at any price, for certain signalling, clear transmission, long life.

Code No. 2696, complete.

Standard Kellogg, 5 bar generator, local and long distance transmitter, "long service" receiver, "fool proof" ringer, induction coil, long lever switchhook, oak cabinet (dove-tail joints—built for years of service).

Pure platinum contacts in hookswitch and generator springs. (Ask the experienced telephone man what that means).

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BRANCH OFFICES: KANSAS CITY, SAN FRANCISCO

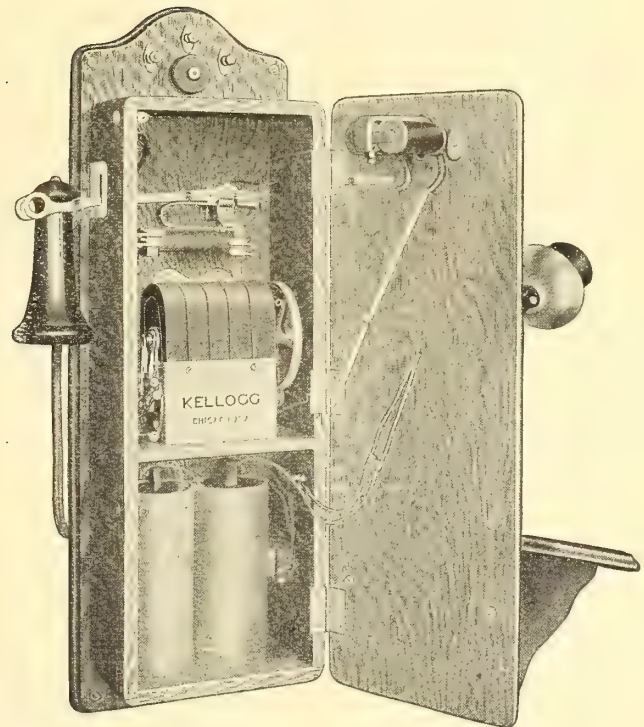
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No Maintenance
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This telephone leaves our factory the same day we receive your order; thoroughly tested, complete, ready to put on the wall, the instant it is removed from the strong yet light and secure packing case. Remember, Code 2696, standard bridging 1600 ohm ringer, 5 bar generator.

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STEEL SHIPBUILDERS, ENGINEERS and BOILERMAKERS

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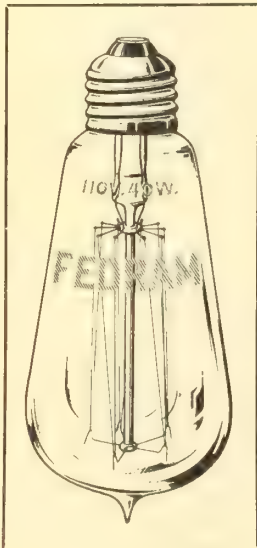
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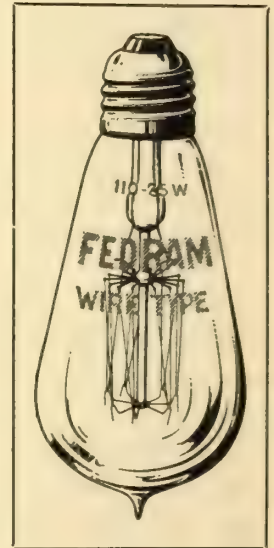
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Write for prices and make arrangements for the Fall trade now

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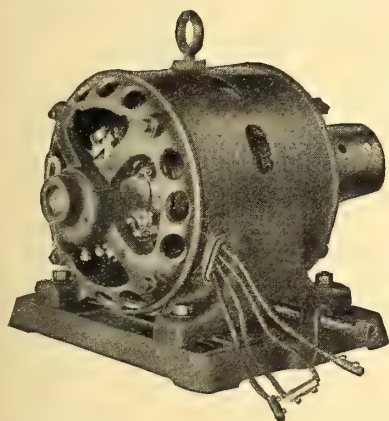
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Everything Electrical

Largest and most complete stock of Pole Line Construction, Lighting, Street Railway and Telephone Material. If you want goods now call on us—we have them. Our facilities are unequalled; our location a distinct advantage for Canadian buyers over other large distributors in the U. S. TRY US.

Century SINGLE PHASE MOTORS

are built to give constant, uninterrupted service. Every part is strong enough to withstand much more than could be expected of a motor of the rated capacity.



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$\frac{1}{4}$ to 40 horse power; 25 to 140 cycles.

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RECTANGULAR UNILETS STEEL — (Not Cast Iron)

Are the most Modern Fittings for Exposed Conduit Work

ONCE TRIED - ALWAYS USED

Because they are much lighter and stronger and at the same time giving more room in the box to do the work than is found in cast iron boxes. They are also very neat in appearance and are now used by the most exacting contractors throughout the land because they **make the job**.

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No. 1



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No. 5L



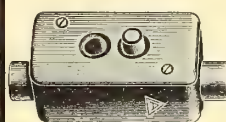
Metal Nipple Cover



Blank Metal Cover

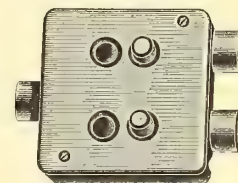


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Type No. 2
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Send at once for our new circular. Specify 'Appleton' on all orders, and get the BEST.



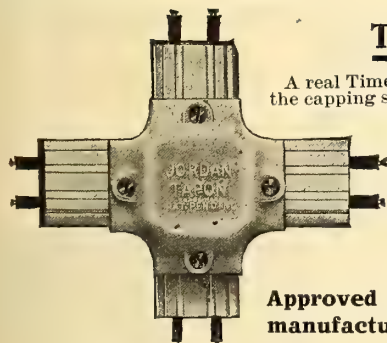
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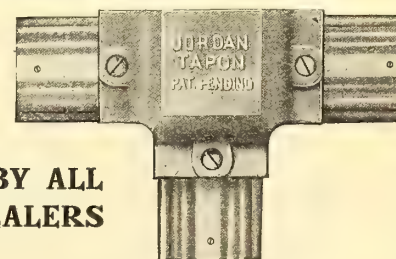
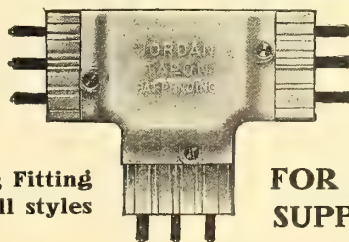
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A real Time Saver which means a Money Saver, making the best class of work. It is not necessary to have the ends of the capping straight as the cover of the Tap-on overlaps the capping, thereby covering any bad ends of capping.



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manufactured in all styles
by



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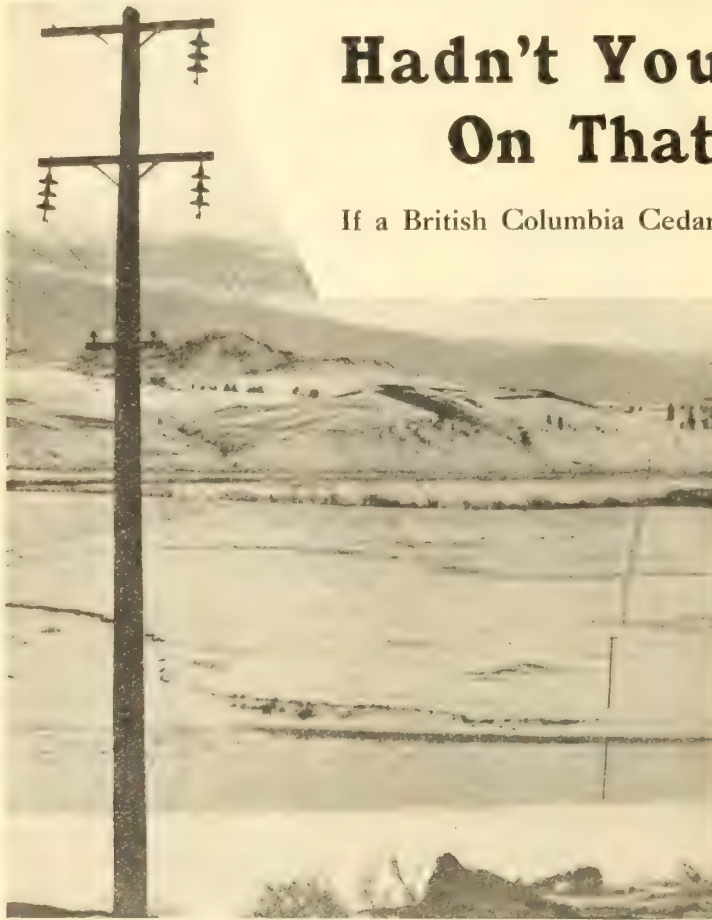
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**CEDAR POLES AND POSTS, TRACK AND
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Hadn't You Better Use Them On That New Extension

If a British Columbia Cedar Pole will stand a strain like this—carry three strands of three copper wires each, one steel ground wire equal in weight to one of the copper strands, and two telephone wires across an 834 foot span without guying?

They will outlast any other pole timber—have practically no crook or butt rot, very few knots—just as perfect a pole as Nature ever grew.

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Send us your next order and be assured of the best possible service. Let us demonstrate the manner in which we take care of our customers.

**Bradley Timber & Railway
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Pole & Tie Co.

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Our yards are located adjacent to Canadian Territory which guarantees

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Service Price Quality
Try Us Once

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We have shipped **B. C. Cedar Poles** to the following points in Canada, viz:

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Waterloo
Woodstock
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Victoria Park

Manitoba
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Battleford
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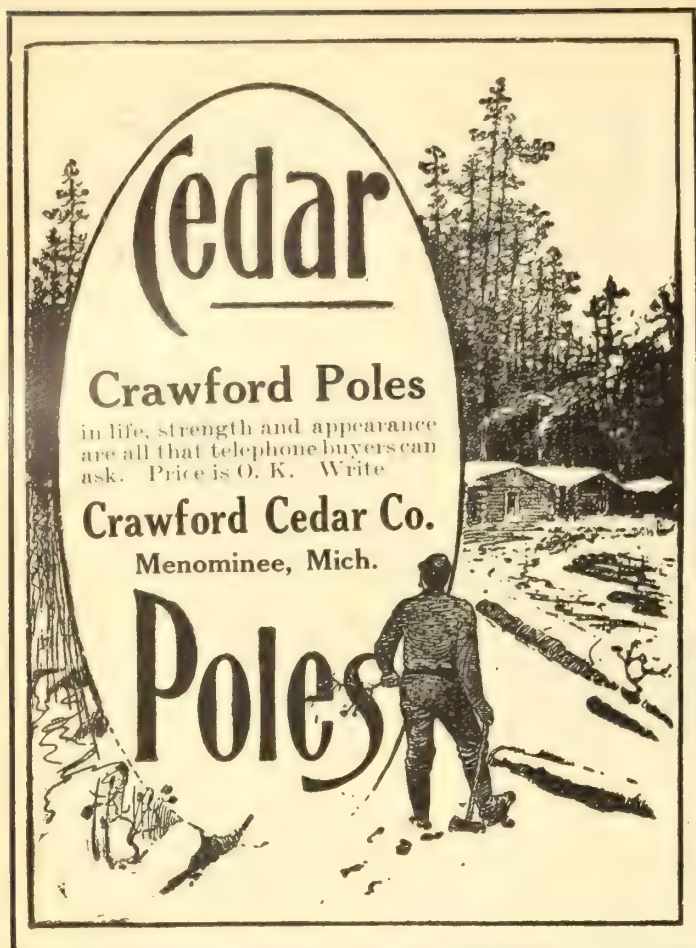
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If you don't find your "Town" in the above list, send us your order, so we can add it to our next list. Your communications will receive Prompt attention. Address:

Western Lumber & Pole Co.

Main Office**"Electric" Building, Denver, Colo.**



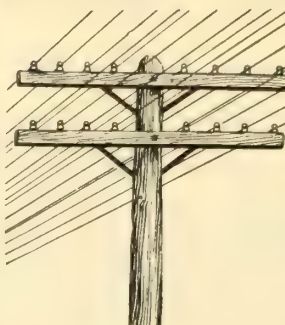
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Crawford Poles
in life, strength and appearance
are all that telephone buyers can
ask. Price is O. K. Write

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Poles

Cross-Arms



Our specialty is manufacturing Cross-Arms from sound straight-grained Douglas Fir.

No order too large for us to fill nor too small to receive careful attention.

Send us your specifications and get our prices before placing your orders.

Cameron Lumber Co.

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A.C. and D.C. Switchboards

SWITCHBOARDS, PANELBOARDS,
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AUTOMATIC BATTERY
SWITCHES, ELECTRICAL
INSTRUMENTS, STORAGE
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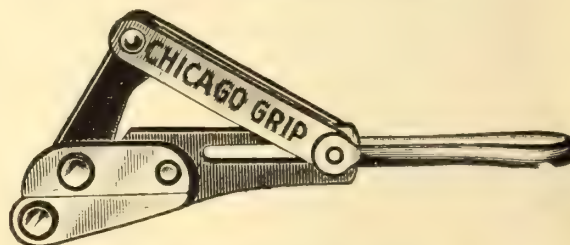
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Estimates and Designs
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THE "CHICAGO" GRIP

IT is made of forged steel; this insures strength, reliability and durability. It has powerful leverage making it hold on wire sure, the gripping jaws are smooth and long, making it safe. The automatic action makes it quick to stick. The draw link is arranged so as to be out of the path of the wire when the grip is being placed. The Workmanship is A1. Finish, Nickel for the smaller sizes, Oxidized Copper for the larger.

Made in two styles for bare and insulated wire, seven sizes, covering the entire range of electrical conducting wires.

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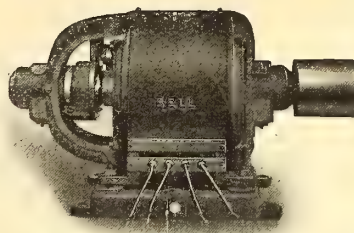
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CEDAR POLES

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"BELL" High Efficiency Single Phase Motors



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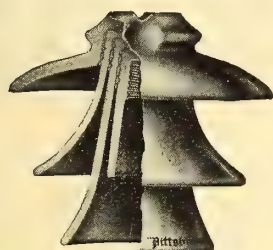
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are designed and made to give the maximum efficiency under the most severe conditions. Uniform glaze, body and appearance. Made for voltages from 4,000 upward.

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Now is the Time

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Mark

Building all over the country is progressing rapidly and you should get busy on the job installing the Electrical Equipment, Lights, etc.

Just back up that live advertising you are doing with Wakefield Standard Universal Lighting Fixtures. Show the prospect the intrinsic values not found in other lines for the same money and he will install Wakefield and YOU will be the richer because they are INTERCHANGEABLE and you won't have to carry much investment to have a nice assortment, and because they are STANDARD you will save a lot of time wiring and installing.

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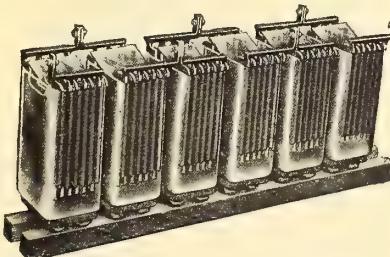
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Vermilion, Ohio, U. S. A.

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25 and 50 Volt

STANDARD CELLS OF
SMALL BATTERY FOR
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DO NOT REQUIRE SKILLED
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THEY ARE SATISFACTORY
IN HOT OR COLD CLIMATE
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Especially desirable
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as auxiliary to the
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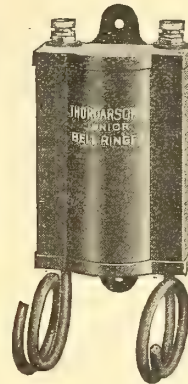
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Up-to-Date Electricians

know what they want. When it is a question of
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THORDARSON Bell-Ringing Transformers



They alone possess every trans-
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"Junior" List Price, \$3.

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DOROTHY POWERS

is only one of many
whose lives have been saved
by our FENDERS AND WHEEL
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years. What these LIFE
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Let us prove to you that we
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"While crossing the street she
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of heroic efforts of the motorman.
Fortunately the car was equipped
with your Automatic Wheel Guard
which scooped up the child and
carried her along until the car was
brought to a standstill. Instead of
my little one being cut to pieces
the only injury was a slight cut
over the right eye.

"Had the car been equipped with the
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Bell Ringing Transformers
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For Satisfying Results in Underground Subway and Power
House Construction specify American Bituminized Fiber Conduit.
Strongest and most durable conduit made.

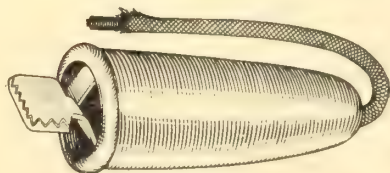
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Write for Booklet and General Information

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Universal Test Clips

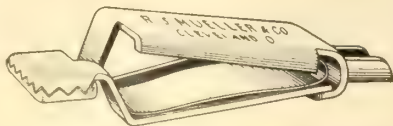


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work requiring
quick temporary
connections.**

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Ask us for a free sample
and then order from our
Exclusive Canadian
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satisfactory service for Ignition or other work we
will credit account, refund money or replace with
new cells.

The Dealer is authorized to make good this guarantee

The Manhattan Electrical Supply Co.

New York

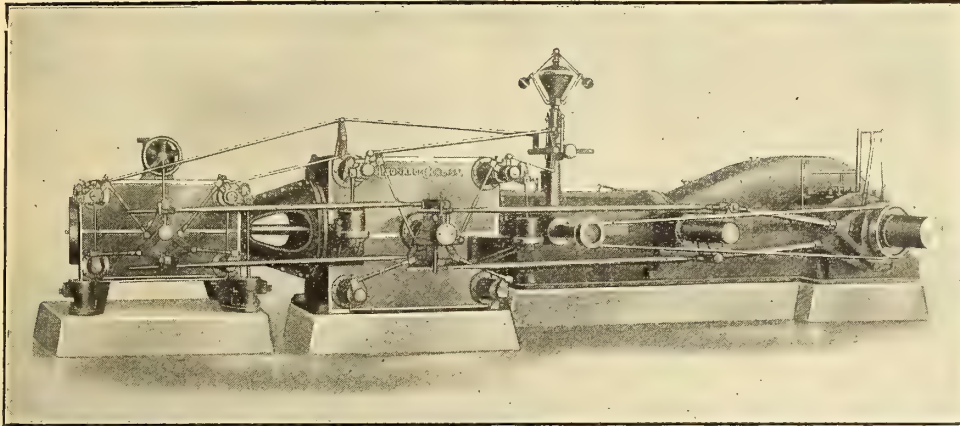
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for Medium and
High Speeds
100 to 235 R.P.M.

Built in Units up
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These engines are
Absolutely Noiseless,
are of **Massive Design**
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The **Frame**, including guides and main bearing, is cast in one solid piece, thus insuring greatest rigidity. **High Economy** is the particular feature of this engine.

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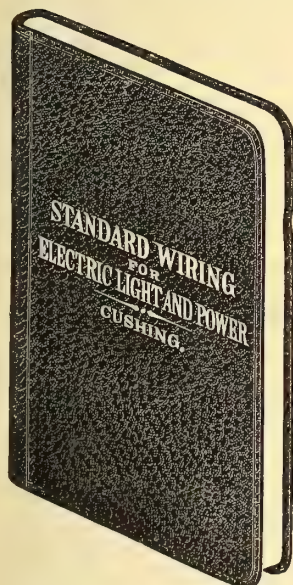
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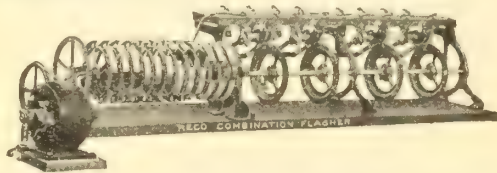
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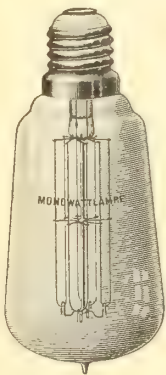
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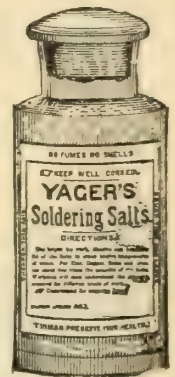
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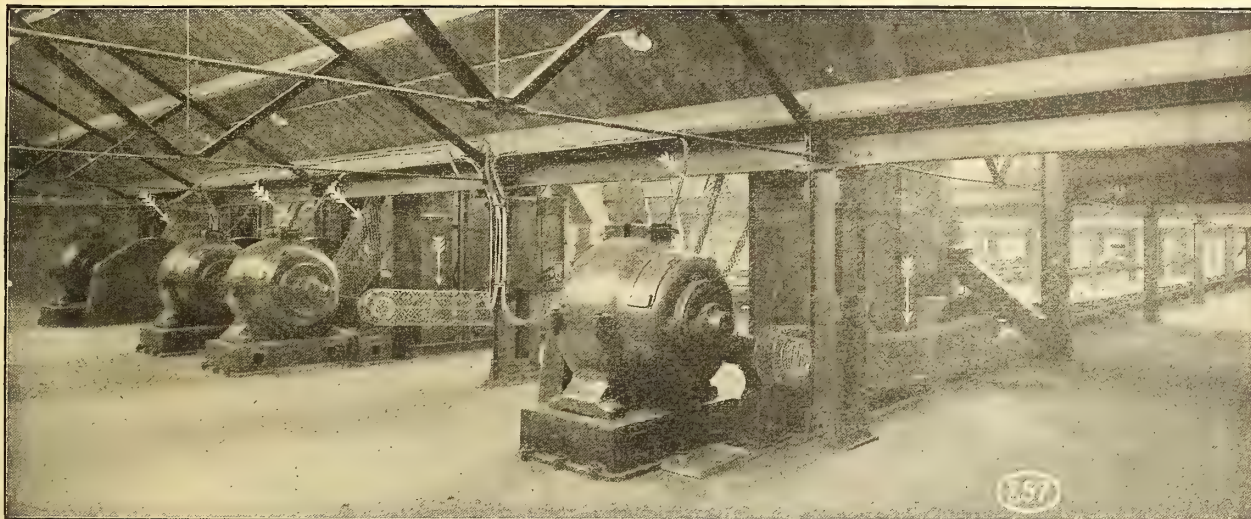
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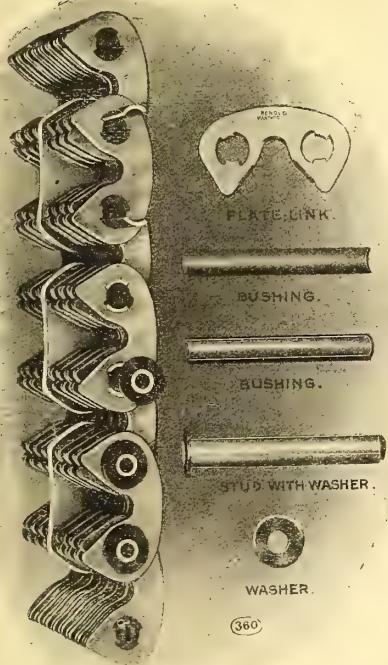
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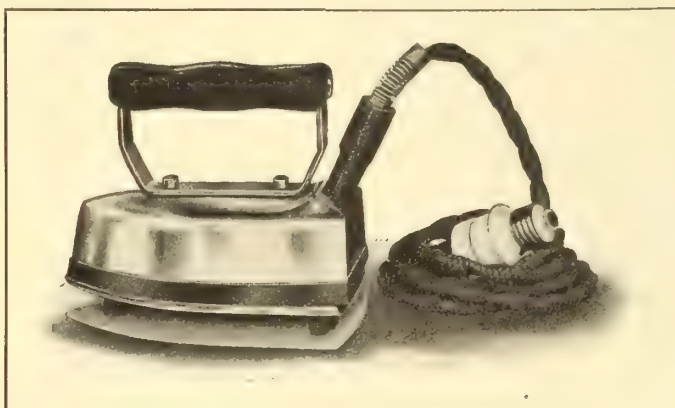
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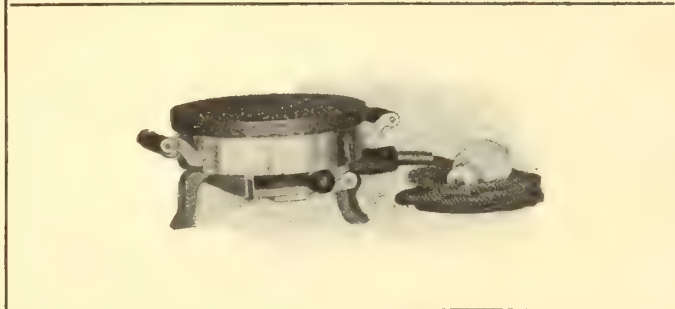
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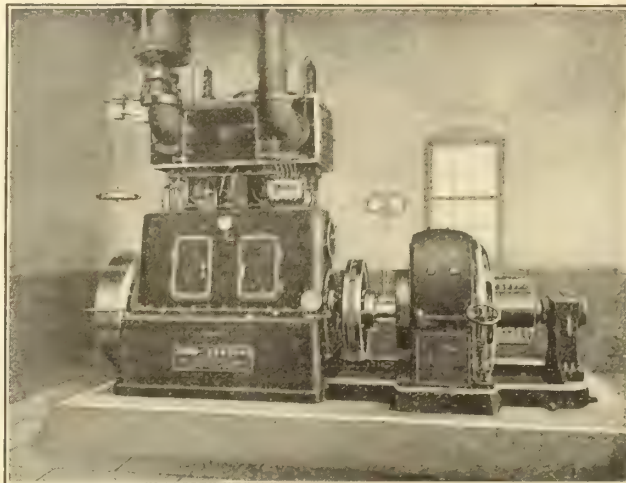
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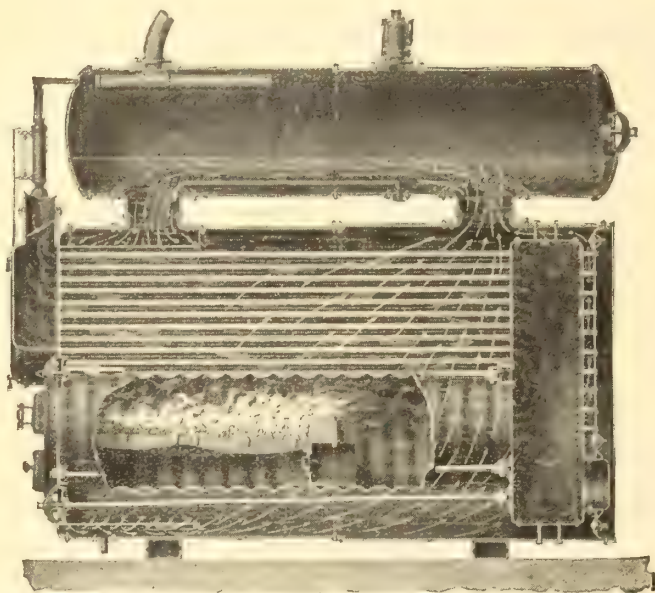
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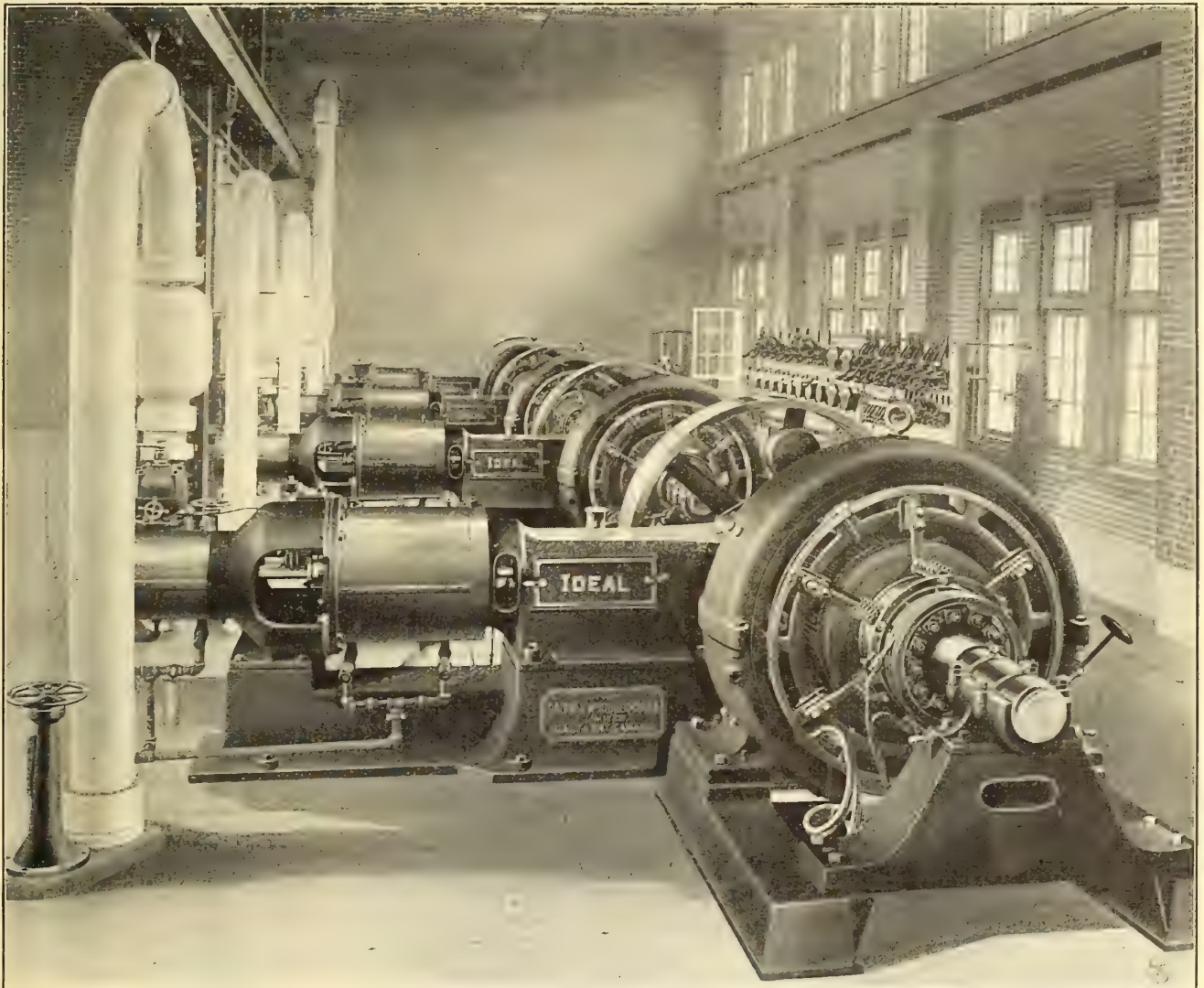


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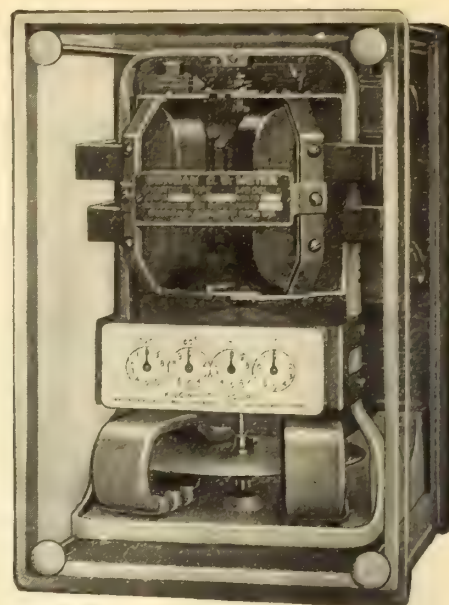
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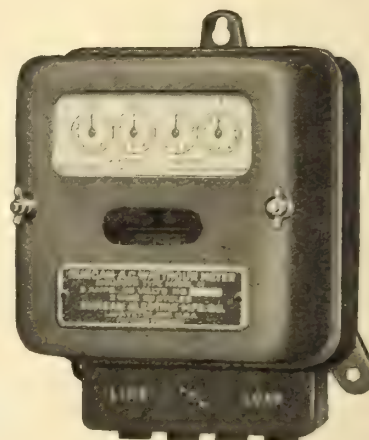
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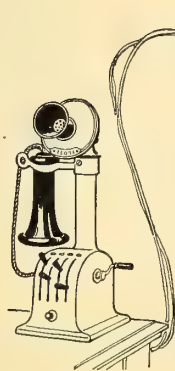
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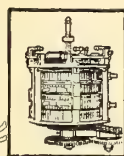
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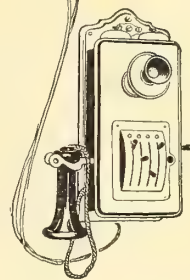


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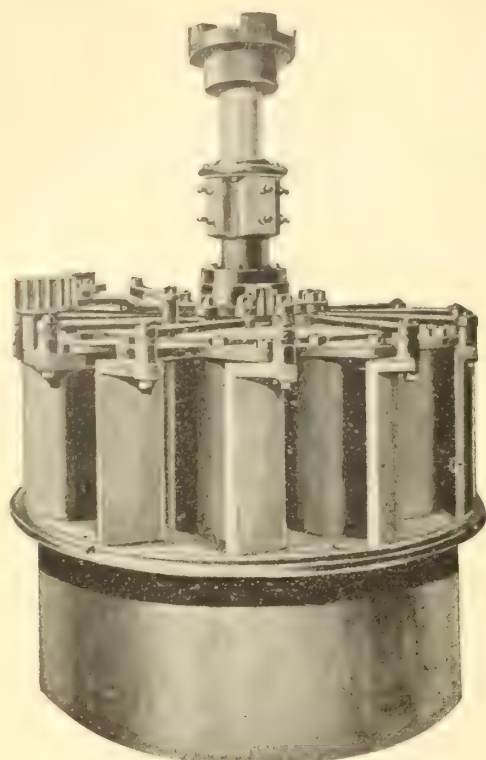
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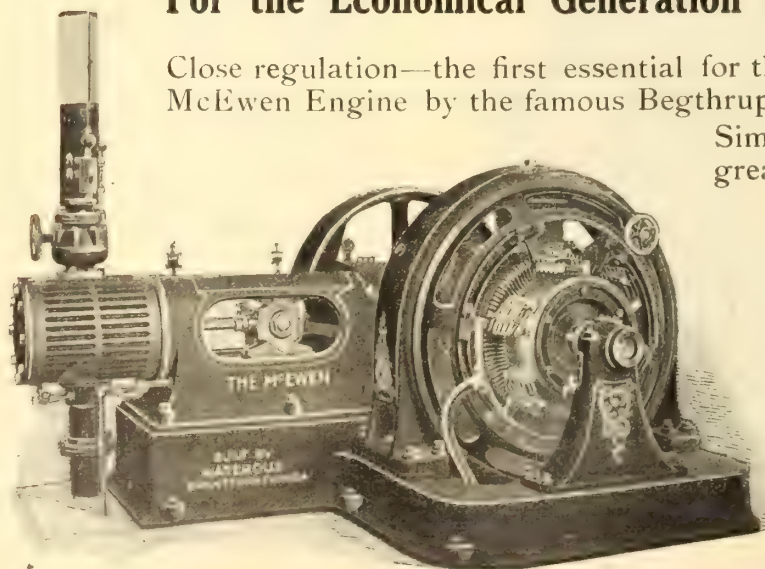
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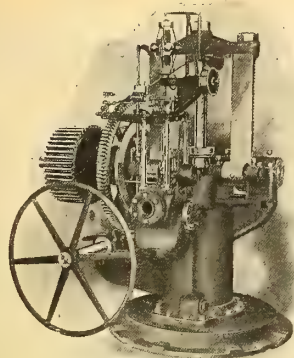
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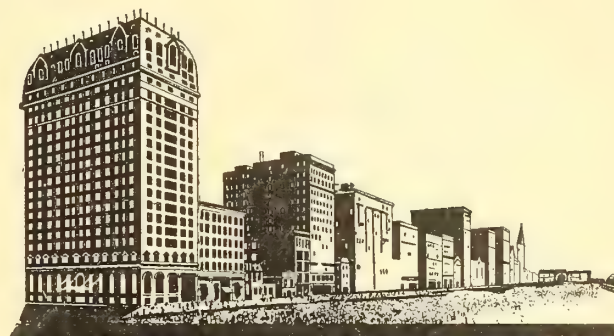
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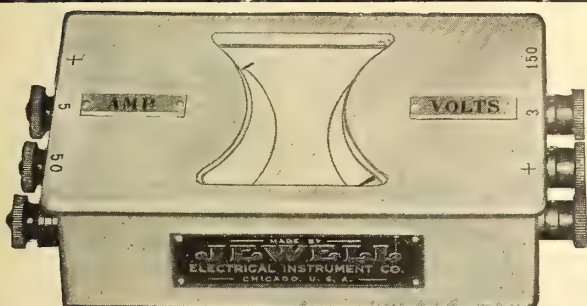
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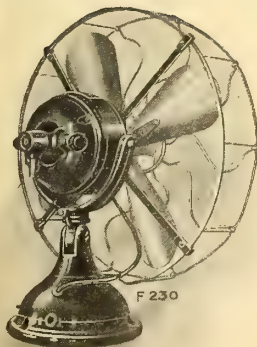


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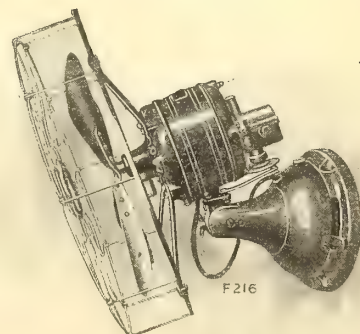
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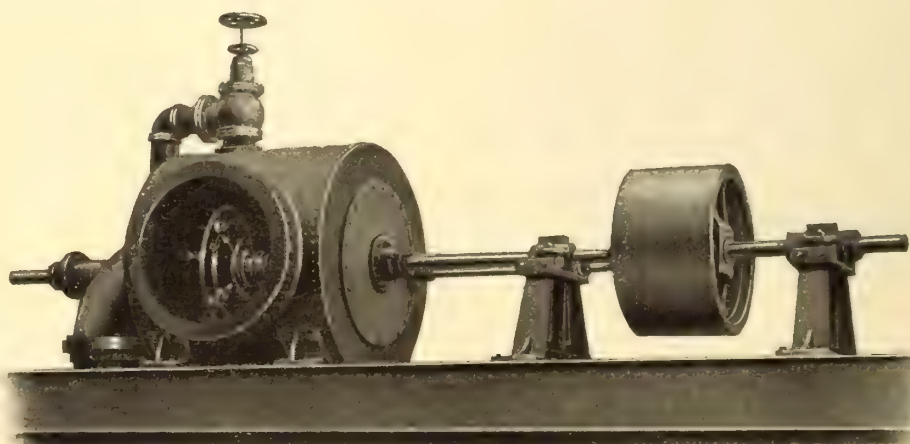
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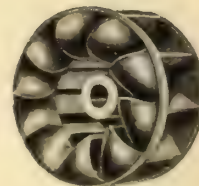
Single 22-inch Canadian Turbine—60 ft. head.



REGISTERED

**Turbine Water Wheel Installations
of Highest Obtainable Efficiency.**

Write for Catalogue and References.



Small Runner

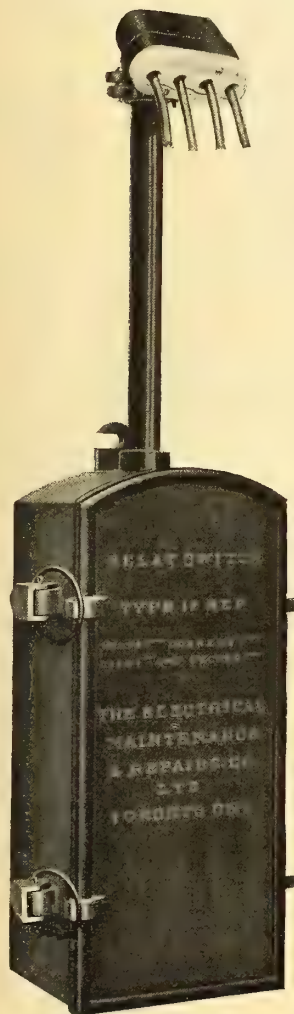
CHAS. BARBER & SONS, Meaford, Ontario

Remote Control Switches

We desire to call the attention of the **Engineers in Convention** to this latest addition to our family of **Remote Control Solenoid Switches**.

Congratulations are in Order

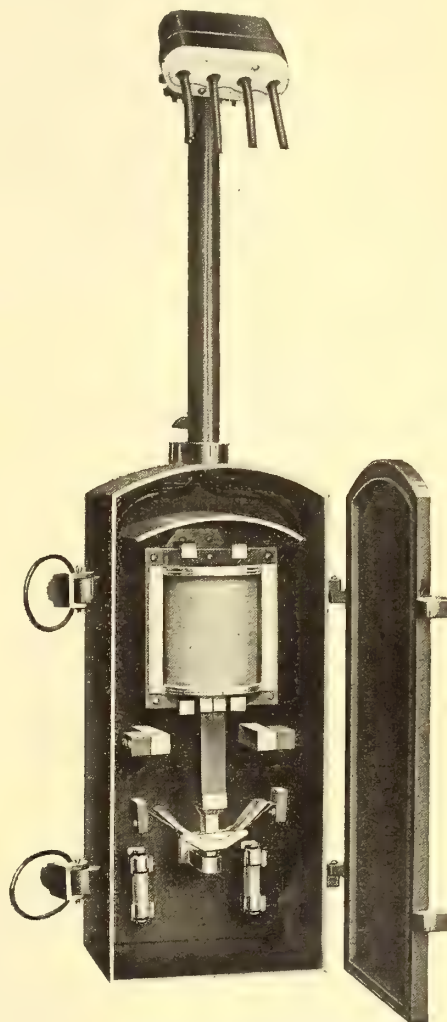
"Though the youngest of the group it is the best developed. Practice makes Perfect you know."



View with Cover Closed

This is our **Type 17 H. E. P.** They have been adopted by the Hydro Electric Power Commission and are in use for **Multiple Tungsten Street Lighting** in

Baden
Beachville
Mimico
Norwich
Port Credit
Port Stanley
and Waterford



Showing Switch Detail

Both lighting and solenoid circuits are fused. The switch is equipped with auxiliary carbon contacts. The cover is fastened by an eccentric movement and is quite weatherproof. They are silent, cool and absolutely dependable.

The Simplest and most Efficient and Reliable system of street lighting yet devised is effected by the use of our Switches.

Investigate this, it is Worth While

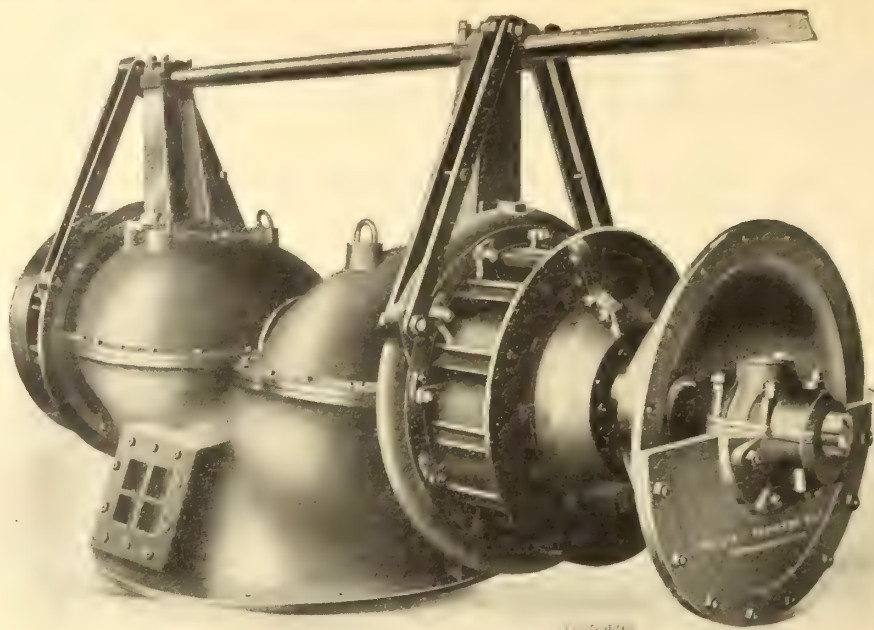
Of course you don't need to be told that we do the best Repair Work in the Dominion.

The Electrical Maintenance & Repairs Co.

162 West Adelaide Street, Toronto

Phones Adelaide 902, 903

Limited



Samson Turbine Wheels

For All Power Purposes

WILLIAM HAMILTON COMPANY, LIMITED, Peterborough, Ont.

"Royal" Switch Boxes and Spacers

Manufactured

in

Toronto

Quick Delivery



Approved by

National Board of

Fire Underwriters

WRITE FOR PRICES

PECK ELECTRIC LIMITED

Jarvis and Adelaide Streets, TORONTO

Manufacturers of Electric Automobiles, Switch Boxes, Spacers, etc.

**CLARK**

**Clamps, Insulators,
Twist Splice
Connectors,
Split Tinned
Connectors**

Write for Bulletins

**CLARK
Elec. & Mfg. Co.**
149 Broadway
NEW YORK

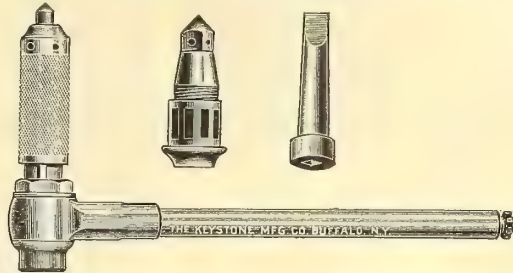


PATENTED

REVERSIBLE RATCHET

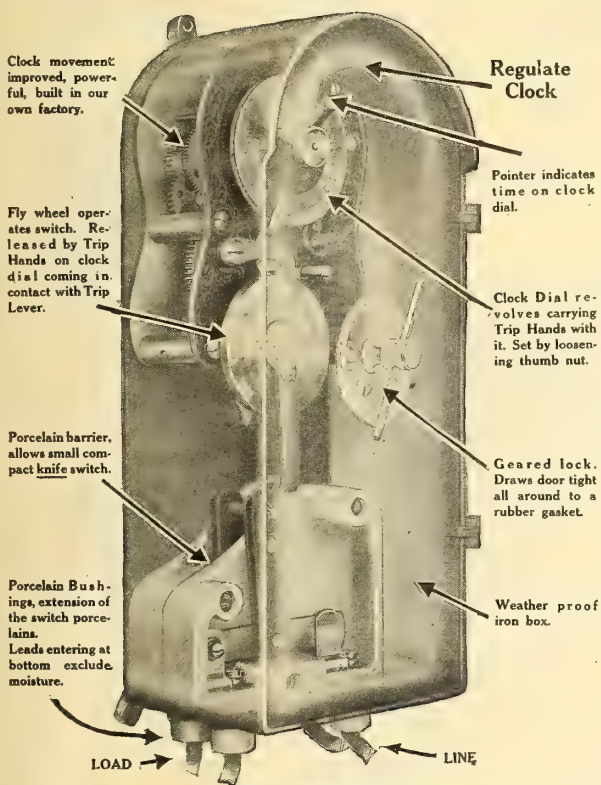
COMBINATION No. 200

Consists of Ratchet for Taper Shank Twist Drills, Sleeve for Square Shank Drills, and Short Boiler Socket for Square Shank Drills (Socket Interchangeable)



THE KEYSTONE MFG. CO., 42 Chandler St., Buffalo, N.Y.

CAMPBELL TIME SWITCH (Patent)
THE BEST



Send for Price List

CAMPBELL ELECTRIC CO., LYNN, MASS.
Canadian Representative—Irving Smith, 406-7 St. Nicholas Bldg., Montreal

Gail-Webb Mfg. Co.

MANUFACTURERS OF

Adjustable Electric Fixtures

Portables, Wall Brackets, Bench and Ceiling Fixtures, Wire Lamp Guards.

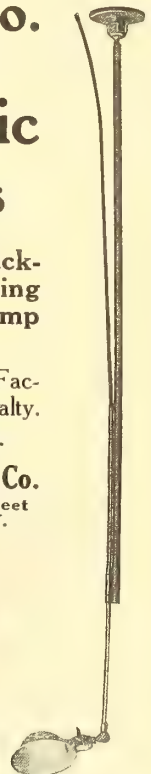
All styles of Office and Factory fixtures a specialty.

Send for catalog.

Gail-Webb Mfg. Co.
135 Washington Street
BUFFALO, N. Y.



Style No. 40
Bench Fixture



Style No. 26
Ceiling Factory
Fixture
Made in all
lengths

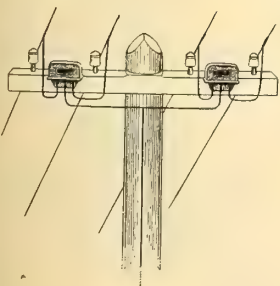
Chapman Lightning Arresters

afford the highest type of
Lightning Protection for

**Telephone, Telegraph,
Train Despatching and
Fire Alarm Lines.**

Carried in stock at Montreal,
Toronto, Winnipeg, Regina,
Calgary and Vancouver by

**Northern Electric &
Manufacturing Co.**

**MICA****KENT BROTHERS**

Kingston, Ont., Canada

Miners, Exporters and Dealers in
Canadian Amber Mica.

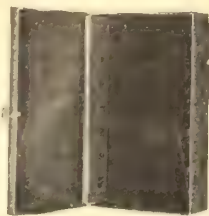
Thumb Trimmed, Cut to Size,
Splittings, Discs, Washers, Etc.

Write us for prices and let us figure on your
requirements.

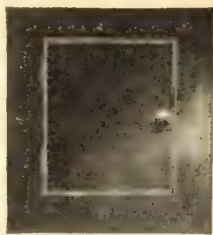


Bushing
for all
Knockouts

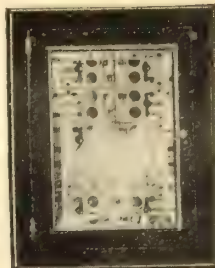
The Most
Complete
Assortment
of Stock,
Sizes and
Styles.



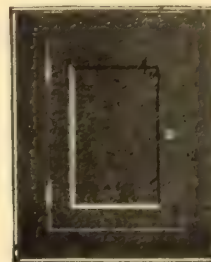
Type A. The usual box.
Dust tight cover.



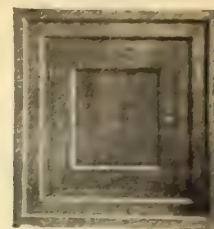
Type P. A cheap box
with a door and trim.



Type C. A better one
beaded and paneled.



Type G. With a beveled
plate glass panel in door.



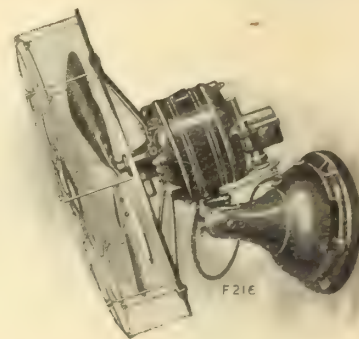
Type SW. Steel, with
natural oak, mahogany
or walnut finish.

COLUMBIA—QUALITY—STEEL CABINETS

Lower Priced. Get Acquainted Now. Write: COLUMBIA, 226 E. 144th ST., NEW YORK

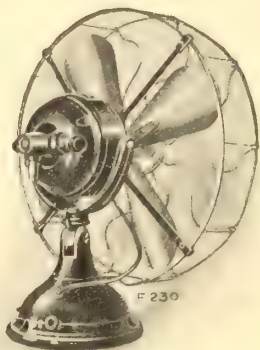
Sell Your Customers Reliable, Economical and Long-Lasting "Standard" Fans

You can build up a splendid trade in Electric Fans by selling a line that is backed by conscientious manufacture and by a strong national advertising campaign.



Model 11 Oscillator D. C. or A. C.

Robbins & Myers "STANDARD" Fans



Model 15 S. & T. Type Fan for D. C.

are built by Fan Specialists with 17 years of constant improvement behind them. Long life and economy of "juice" are strong points of the "Standard" line.

They are noiseless and throw out the maximum amount of air using the minimum amount of current. It will please your customers when you sell them such an economical and efficient fan.

Be prepared to deliver when your customers who read the story of "Standard" quality in the Saturday Evening Post, etc., ask for these Fans.

Write at once for more facts and particulars of our Fans and dealer's proposition.

The Robbins & Myers Co.
Manufacturers - SPRINGFIELD, OHIO

We also manufacture small motors both D. C. and A. C. for all purposes.

SNAP! AND THE BUSHING IS LOCKED!

A Bushing Simpler, Cheaper and Better than Anything Now on the Market

It consists of a Vitrified Porcelain Bushing on the neck of which (diametrically opposite) are several slots or indentations as shown in Figure 1, and a copper plated Steel Clamp (Fig. 2) with spring arms which when placed into position in any of the slots (according to the thickness of the metal or other substance), at once forms an absolutely tight fastening which locks itself automatically. (See A-Fig. 2).

Figure 3 shows the Bushing and Clamp in place.

These bushings are made in seven standard sizes, but of course can be made any special length and diameter to suit the occasion.

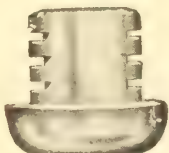


FIG. 1

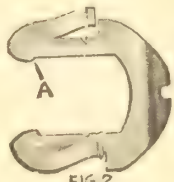


FIG. 2

Patent Applied for.

Manufactured
by

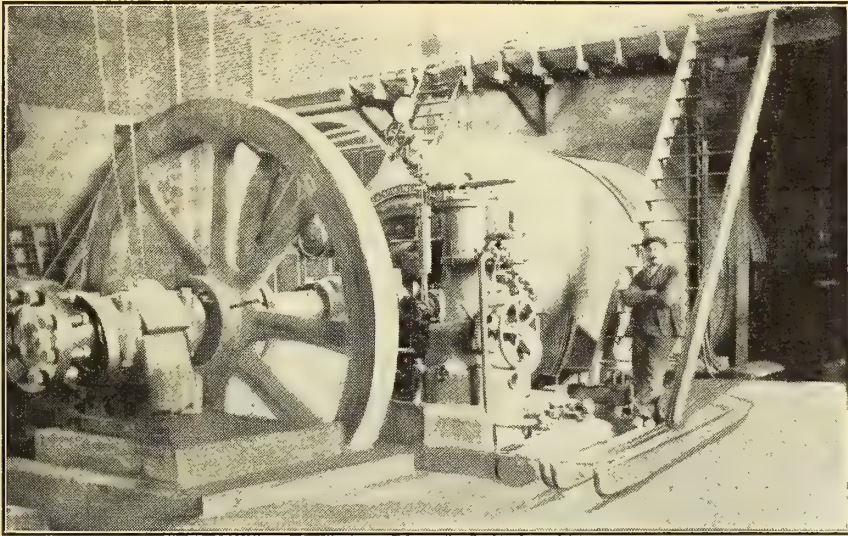
AMERICAN BUSHING CO. 69 W. Washington Street,
CHICAGO, ILL.

Sold by all Leading Jobbers.

Approved by the Underwriters Laboratories.



FIG. 3



The illustration shows one of the two 3,750 B. H. P. Turbines and Oil Pressure Governor Supplied to the Calgary Power Co.

Turbines — and — Governors

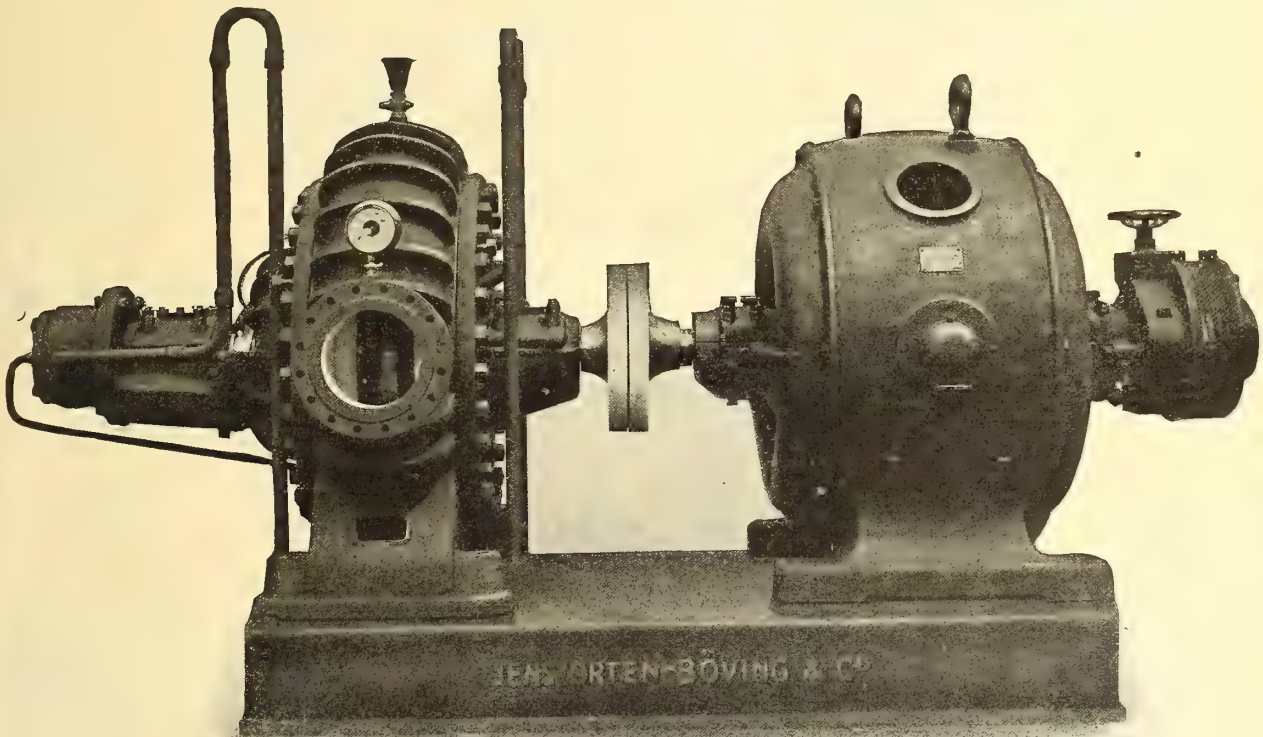
Seven Different Sizes of
Governors Made

Suitable for all Conditions

No Racks No Gears

Absolutely Self Contained

TURBO PUMPS FOR HYDRAULICING



The pump illustrated was installed by the Nipissing Mining Co. for sluicing purposes. A hill of gravel and stones being sluiced off the rock by means of a high pressure jet produced by this pump.

HEAD 415 FEET—CAPACITY 4,000 IMP. GALS. PER MIN.—710 B. H. P.

For Further Particulars Apply to:—

The Canadian Boving Company, Limited
PIPE 164 Bay Street, TORONTO **LINES**
Vancouver Office: 448 Seymour St.



CHATEAU LAURIER, OTTAWA, CAN. Grand Trunk Railway System

The new \$2,000,000.00 Hotel situated in the heart of the Dominion Capital

Accommodation 350 Rooms.

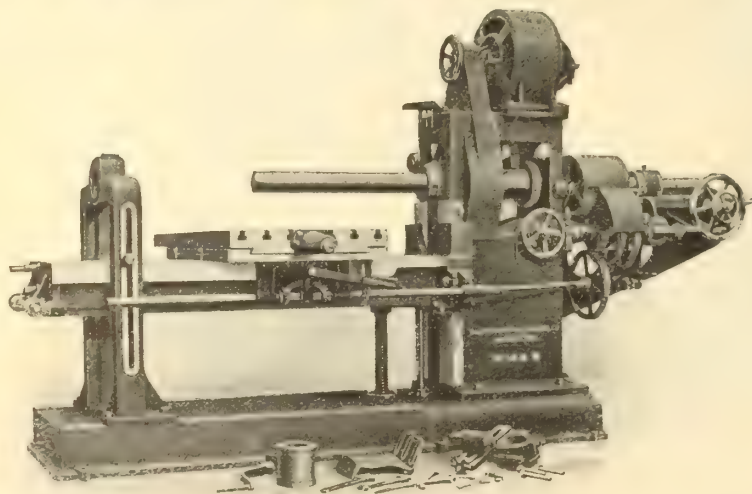
The latest in Hotel construction.

Furnished with exquisite taste and comfort.

Rates \$2.00 upwards. European plan.

F. W. BERGMAN, Manager in Chief Hotels,
Grand Trunk Railway System

Bertram Boring and Drilling Machines



For all classes of work, including

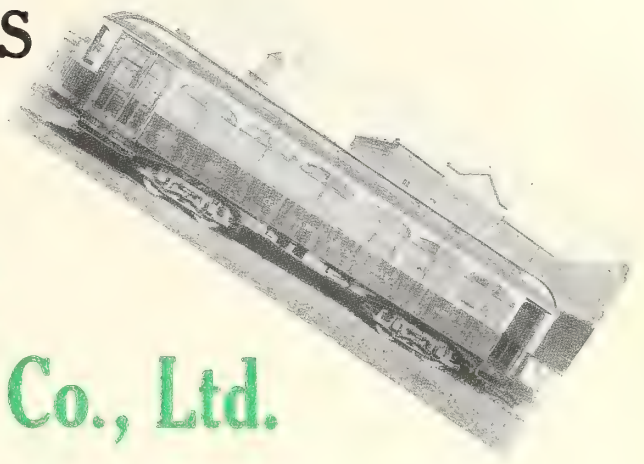
Car Wheel Boring Machines
Car Box Boring Machines
Locomotive Rod Boring Machines
Horizontal Boring & Drilling Machines
Vertical Boring & Turning Mills
Vertical Drilling Machines
Suspension Drilling Machines
 Etc.

8 ft. Horizontal Boring & Drilling Machine—Motor Driven

The John Bertram & Sons Co., Limited
 DUNDAS, ONTARIO, CANADA

Sales Agents: The Canadian Fairbanks-Morse Company, Limited.

**"LOOK"
AT
THIS**



**The
Ottawa Car Co., Ltd.**

are Designers and Builders of

Electric City
and Interurban
passenger cars.
Electric ex-
press cars and
locomotives.
Snow sweep-
ers, sprinkler
and work cars.



Car Seats,
Car Curtains,
and a very
large variety
of Brass and
Bronze Car
Fittings.

"Send Them Your Inquiries"

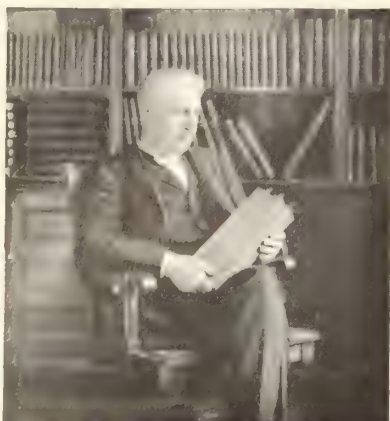
as they are at your service for
specifications, drawings,
estimates and
prices.



Satis-
faction as-
sured on all or-
ders and deliver-
ies made promptly.



Remember the Address: **COR. KENT AND STATE STS., OTTAWA, ONT.**



Thomas A. Edison

*The Only Storage
Battery in the World
whose Capacity is
Guaranteed for Five
Years.*

Other storage batteries last for a season only, but the Edison Storage Battery is guaranteed to last five years. The life of an Edison Storage Battery in ignition service is practically unlimited.

The Edison Storage Battery is working a revolution in the battery practice of the world. In every particular—reliability, length of service, simplicity, cost of operation—it is far ahead of any other storage battery ever made.

The Edison Storage Battery is built of nicked steel. The active materials are nickel hydrate and iron oxide. The electrolyte is alkaline (potash) and not acid, consequently there is no sulphation or corrosion of plates, no corrosion of terminals, or running gear, and no rotting away of trays. Iron or steel immersed in a potash solution will last indefinitely.

The Edison Storage Battery grows in capacity immediately it is put into service. How about the others in this respect? The Edison cell may be discharged to zero and left standing indefinitely and no harm will result. All that is needed is to charge up and go ahead. Can leave it in any condition for any length of time. Cannot injure it by overcharging. Vibration does not harm it. It is fool-proof.

The initial cost of the Edison Battery is greater than others, but as it will last five times as long and is more dependable it is really the most economical battery made.

We can supply the Edison cell for ignition and lighting purposes. It is the ideal cell for gas engine ignition, operation of railway signals, lighting of railway cars, isolated homes, power boats, and a multitude of other electrical devices.

Write to our nearest branch for a circular giving a full description and history of the Edison Storage Battery.

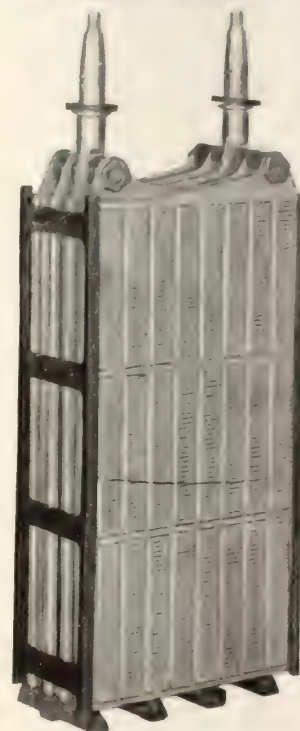
**The Canadian
Fairbanks-Morse Co.**

Limited

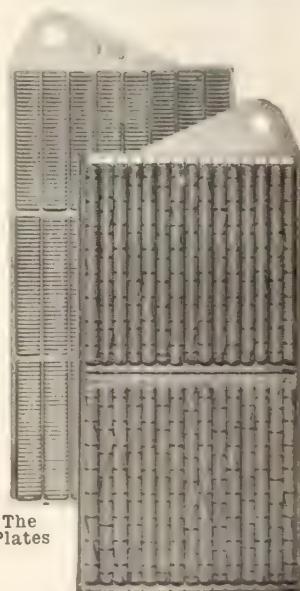
Montreal, Ottawa, St. John, Toronto, Winnipeg,
Saskatoon, Calgary, Vancouver, Victoria.



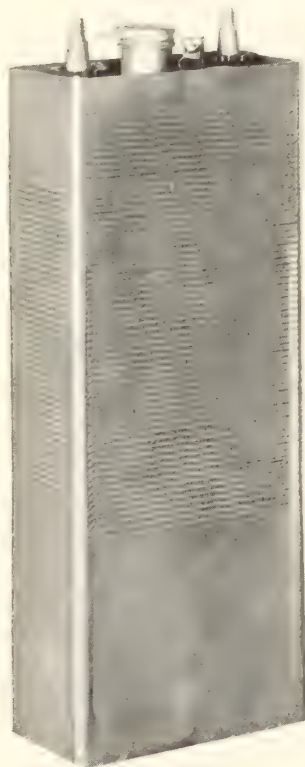
Complete Ignition Outfit



Type A-4 Cell—Assembled, but entirely removed from Container



The Plates



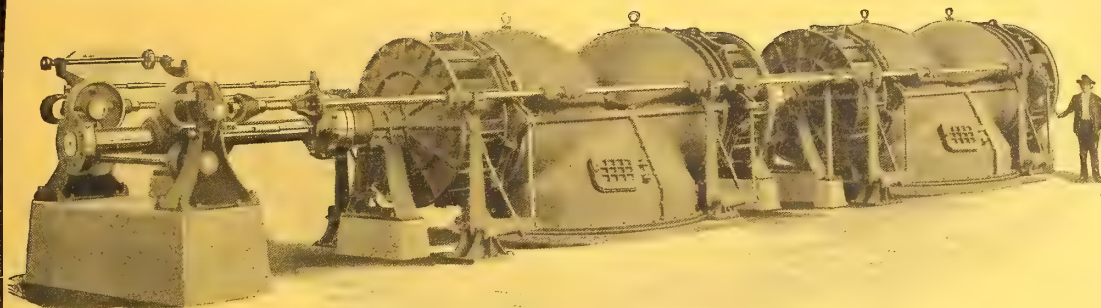
Completely assembled ready to be connected up



Type B-4 Cell

Electrical News

Generation, Transmission and Application of Electricity



Hydraulic Turbines

One Unit of Turbines of 3,200 H.P.
30' Head Furnished
J. R. BOOTH,
Ottawa, Canada

Turbines Furnished
for Heads from 5 feet
to 600 feet.

Branch Offices:
167 Federal St., BOSTON,
MASS.
American Trust Bldg.,
CHICAGO

S. Morgan Smith Co., York, Pa.

Mercury Arc Rectifiers

A simple method of correcting light loads.

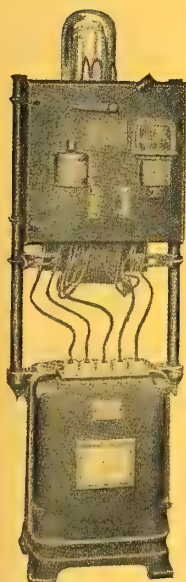
Simple and Efficient

No moving parts—require no oil.
Can be operated by man or woman.

For Battery Charging of All Kinds

Will deliver direct current wherever alternating
current is available.

8,000 Rectifiers are used for charging Electric
Vehicles.



Moving Picture
Rectifier



Battery Charging
Rectifier

Canadian General Electric Co., Limited

Toronto Montreal Halifax Ottawa Cobalt Winnipeg Calgary Vancouver Nelson

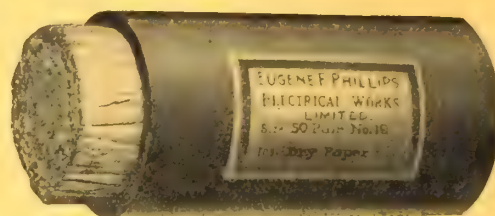
PHILLIPS



Bare and Insulated Copper

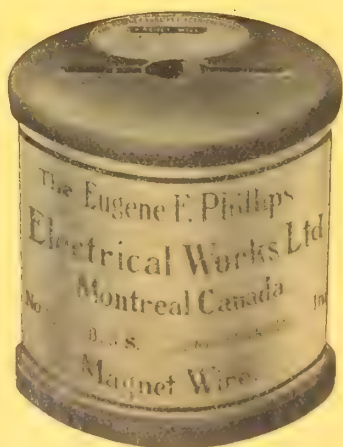
WIRES AND CABLES

For Telephone, Telegraph, Lighting,
Power and Street Railway Equipment



Bare and Insulated Electric Wire and
Cables for Aerial and Underground use

Railway, Feeder and Trolley Wire



Weatherproof Magnet
and Rubber Covered
Wires and Cables



Incandescent and Flexible Cords

Eugene F. Phillips Electrical Works, Limited

MONTREAL

CANADA

Branches: Halifax, Toronto, Winnipeg, Vancouver



Cat. No. 240

The Drop Cord Socket 240 is a one-piece porcelain pendant socket with threaded bushing constituting the cap. It is provided with back connections lying in the cavity covered by the cap. The latter, in combination with a projection on the porcelain forms an effective cord grip, making it unnecessary to use other strain relief means. Outside positioning offsets for attaching reflectors make it possible to use smaller lamps by simply shifting the reflector from the lower to the upper position; likewise admit changing of light distribution without changing the reflector. The bushing has a $1\frac{1}{2}$ " opening for accommodating reinforced cord, but will also grip individual wires in ordinary cord.

WRITE FOR FREE SAMPLE

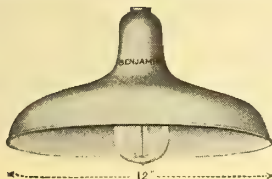
B
E
N
J
A
M
I
N



Cat. No. 5525

Fixture 5525 is a sign reflector socket consisting of an integral enameled steel reflector and No. 89 two-piece receptacle. The former measures $11\frac{3}{8}$ " across the opening, is irregular in form, and set in position at an angle to secure an even light distribution on a vertical sign board. It may be mounted on gooseneck or other desirable means. Bushing furnished is regularly tapped for $\frac{1}{2}$ " iron pipe, but may be ordered $\frac{3}{4}$ " without change in price. 60 or 100-watt lamps may be used. Lamp grip, described below, furnished without extra charge.

WE AIM TO GIVE THE ELECTRIC TRADE—THE BEST DEVICES—THE BEST MATERIAL—THE BEST WORKMANSHIP—THE BEST DELIVERY
OTHERS AIM AT OUR RESULTS

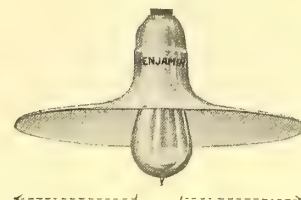


Bowl Type

The Benjamin Lamp Grip is a device intended to forestall the loosening and falling of lamps. A simple spring means engages the lamp base with sufficient force to hold it in position. It thus prevents loss from breakage, saves the time necessary for re-adjusting, and renders accidents in dangerous quarters where the lamp might strike the workman impossible. It is of particular value in the industrial field, places exposed to the wind, on steam cars, street cars, steamships, or wherever a lamp socket is subjected to excessive vibration.



SAVE YOUR LAMPS



Flat Type

THIS LAMP GRIP supplied in all our REFLECTOR SOCKETS—for large base 500 watt lamps—or all small base sockets WITHOUT EXTRA CHARGE.

All Electrical Jobbers carry a stock of "Benjamin."

Write for Catalog C-20

Benjamin Electric Mfg. Co.

64 York Street, TORONTO

Porcelain Fittings for Summer Park Lighting

NORBITT CLEAT FITTINGS



Receptacle without
Shadeholder Groove

Have Enclosed Contacts and Eliminate Taps and
Tapped Joints. Caps Installed After all Rough
Work is Completed.



Receptacle with
Shadeholder Groove



Fixture Rosette

Base is secured to supporting surface by two screws. Initial electrical connection to circuit wires is made by two binding screws on top of base. Cap is secured to base by two screws so held in screws hole that they cannot fall out. These two screws also complete electrical connection.



Cord Rosette

WRITE FOR PORCELAIN CATALOG, BULLETIN NO. 11

Crouse-Hinds Company of Canada, Limited



Main Office and Works:

Toronto, Ont., Canada



and for All Temporary Decorative Installations

CROUSE-HINDS and NORBITT SOCKETS



Norbitt
Temporary Socket

Norbitt Temporary—Cap is secured to base by a single screw which passes through center of cap and engages nut in base. Two pointed screws in cap pierce insulation on circuit wires and make electrical connection.



Norbitt
Weatherproof
Socket



Norbitt Weatherproof—Eight-inch leads are sealed in socket and soldered to nuts, which engage two receptacle-contact screws. Crouse-Hinds Temporary Decorative Weatherproof—Circuit wires fit into parallel grooves under hood. Two pointed screws from terminal plates pierce insulation on wires and make electrical contact. These screws are rigidly mounted and cannot work off centre.—WRITE FOR PORCELAIN CATALOG, BULLETIN NO. 11.



Crouse-Hinds
Decorative
Socket
(Front View)



Crouse-Hinds
Decorative Socket
(Side View)

Crouse-Hinds Company of Canada, Limited

Main Office and Works:

Toronto, Ont., Canada



ADANAC Red Core Rubber Covered WIRES & CABLES



Adanac Red Core Rubber Covered Wires and Cables

are made according to the specifications of the National Board of Fire Underwriters. The conductors are drawn from copper of the highest conductivity and are covered with two thicknesses of thoroughly vulcanized rubber compound of high quality. The wires are braided over insulation and the smooth high finish they receive makes them specially desirable for conduit work.

IMPERIAL WIRE & CABLE COMPANY Limited MONTREAL

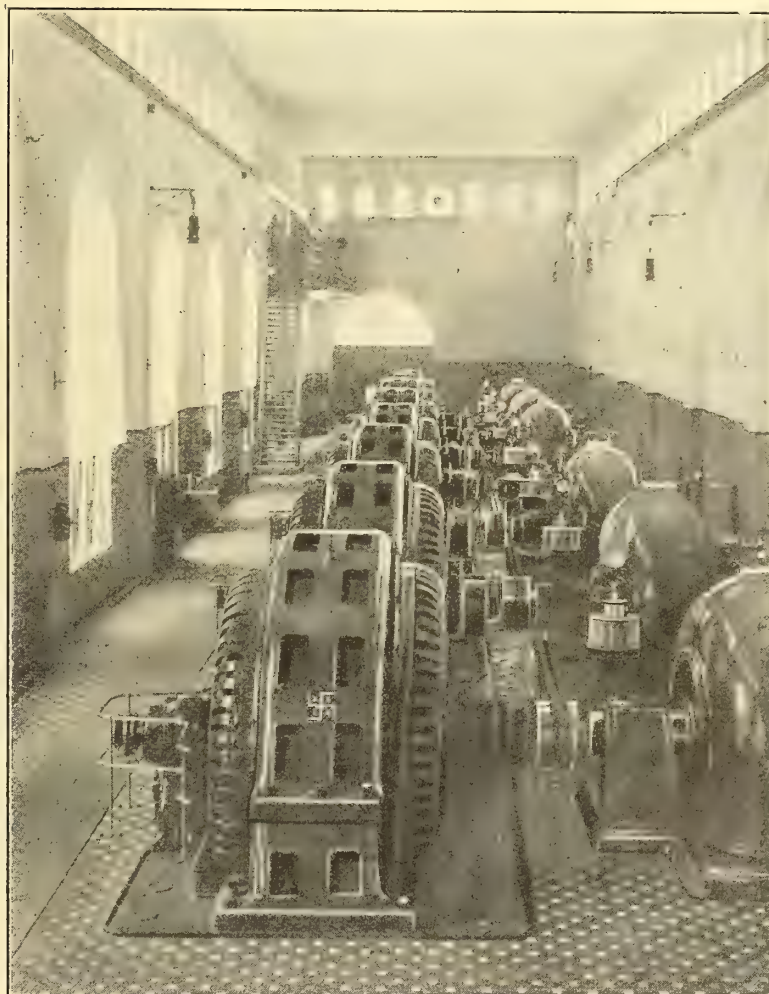
THE *Northern Electric*
AND MANUFACTURING CO. LIMITED

SALES AGENTS

TORONTO WINNIPEG
REGINA
CALGARY VANCOUVER

High Grade Electrical Apparatus

A. C. Generators
 A. C. Motors
 Switchboards
 Transformers
 D. C. Generators
 D. C. Motors
 Electrical
 Machinery for
 all Purposes



Our Machines
 are
 Manufactured
 from the
 Highest Grade of
 Material
 Obtainable
 for Electrical
 Purposes

Six 4,100 K.V.A. 12,000 Volt 25 Cycle 3 Phase 375 r.p.m. Generators
 Installed at Tysse Falls, Norway

Kilmer, Pullen & Burnham, LIMITED

Head Office,
 TORONTO



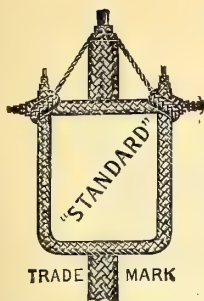
Branch Offices: MONTREAL
 General Supplies Ltd.,
 CALGARY, ALTA.

SOLE DEALERS FOR
 The General Electric Co., of Sweden

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		Electric Railway Improvement Co.	30	Oshkosh Mfg. Co.	36
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Bell Electric Motor Co.	89	Flexible Conduit Co.	36	Company	90
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Limited	34	Hamilton Co., William	104	Superior Electric Mfg. Co.	84
Clark Electric Mfg. Co.	85			Stuart Howland Co.	87
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Central Station Heating & Construc-				Toronto & Hamilton Electric Co.	28
tion Co.	24	Locke Insulator Mfg. Co.	31	Trolley Supply Co.	99
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Company	28	Lowell Wire Co.	108	Thomson, Clarence	96
Canadian Carbon Co.	30	Le Valley Vitae Co.	108		
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Clermont Sewer Pipe Co.	92	Lombard Governor Co.	100		
Canadian General Electric Co.	94-95			Weidmann, H.	36
Canadian Bridge Co.	100	Monarch Electric Co.	17	Western Electrical Instrument Co.	81
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The Advertisements in the "Electrical News" represent the leaders in their line

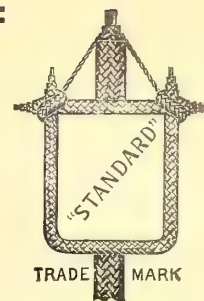


“Standard” N. E. C. Rubber Insulated Wire and Cable

“Sterling”

“Tip-Top”

“30% Para”



have always maintained their own high standard of quality and have kept well in advance of the requirements of Code Specifications and Tests.

It is “STANDARD” POLICY to keep their quality at a point which will secure maximum *Durability, Safety and Economy* for you and a fair profit for ourselves.

“STERLING” N. E. C. wire is a high grade product that will give durable service wherever rubber covered wire is required. It does not, however, compete with wire that is sold entirely on a price basis.

“TIP-TOP” N. E. C. wire will be found on the “preferred wire” list of Architects and Contractors of the more important buildings on the continent. Ask them the reason! Names on request.

“30% PARA” is the “ultra” N.E.C. wire for those looking for the best, regardless of first cost. It is widely specified where quality is the primary basis of competition.

Our large new plant at Hamilton, Ont. has every facility for keeping manufacturing costs down to a minimum and of serving you promptly and economically.

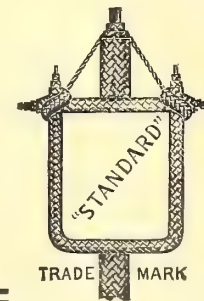
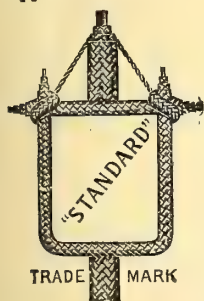
We are in a position to quote you prices on Rubber Covered Wire and Cable that are as low as products of equal quality can be successfully sold. *We court the competition of goods manufactured on a merit basis.*

Standard Underground Cable Co., of Canada Limited

Department E

Hamilton, Ont.

Manufacturers of Electric Wires and Cables of all kinds, all sizes, for all purposes, also Cable Terminals, Junction Boxes, Insulating Compounds, etc.



“Galvaduct” and “Loricated”

The Conduits that can be Depended
on for Long and Efficient Service



Chateau Laurier Hotel, Ottawa—A Galvaduct Building

QUALITY AND DURABILITY

are essential features in Conduits. These qualities are found in the highest degree in **“GALVADUCT”** and **“LORICATED”**.

The work of installing good Conduit costs no more. Besides they eliminate unexpected and often disastrous mishaps.

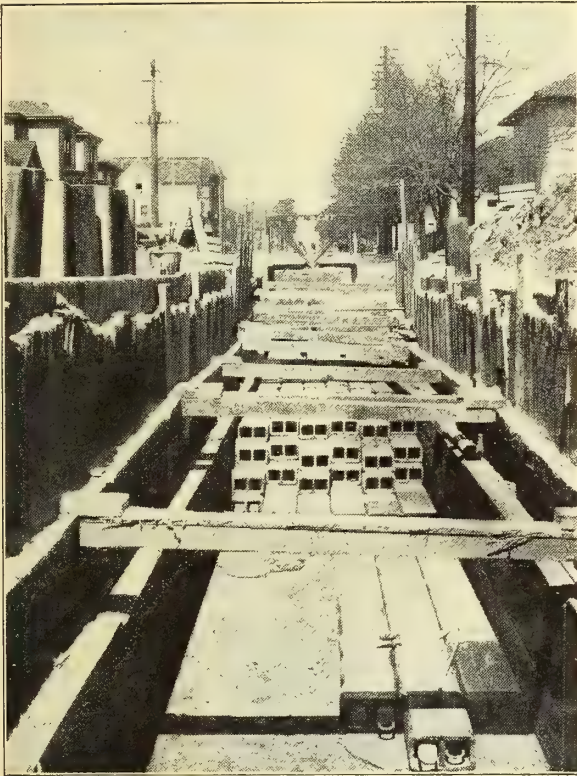
Always specify the Conduits made by

Conduits Company Limited

Toronto and Montreal

G. M. GEST

Conduit Engineer
and Contractor



Electrical Underground Conduit Systems

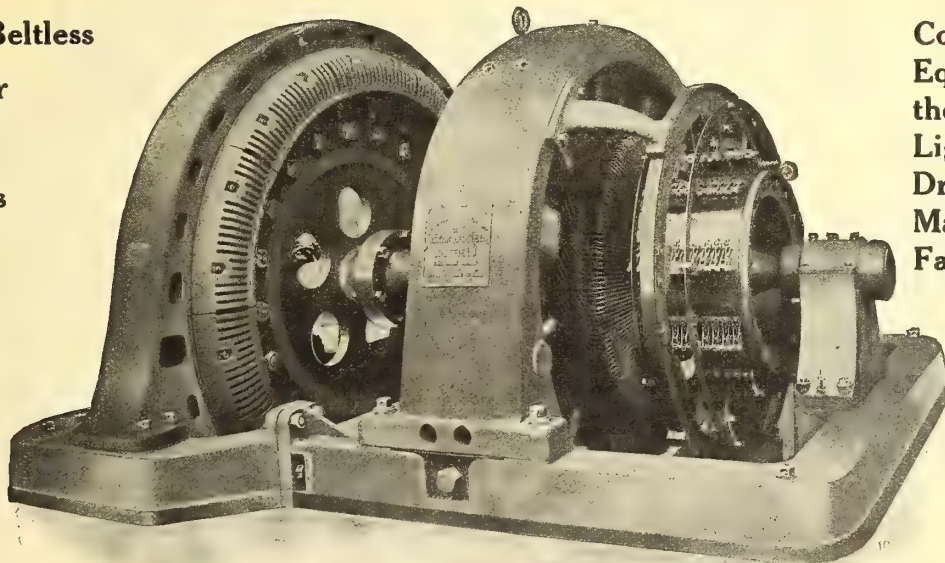
When **G. M. GEST** designs and constructs your Conduit System you receive the benefit of many years' experience and specializing in that line of work.

Power Building, Montreal, P.Q.

VICKERS ELECTRICAL PLANT

MOTORS OF ALL TYPES ROTARY CONVERTERS TURBO-ALTERNATORS

Patent Beltless
Drive for
Planing
Machines



Complete
Equipments for
the Electrical
Lighting and
Driving of
Machine Shops,
Factories, etc.

500 K.W. Three Phase Synchronous Motor Generator

Head Office for Canada: Lewis Building, Montreal
Mr. J. P. I. Thomas (Representative)

Works:
River Don Works, Sheffield, England

"LOOK"
AT
THIS

The
Ottawa Car Co., Ltd.

are Designers and Builders of

**Electric City
and Interurban
passenger cars.
Electric ex-
press cars and
locomotives.
Snow sweep-
ers, sprinklers
and work cars.**



**Car Seats,
Car Curtains,
and a very
large variety
of Brass and
Bronze Car
Fittings.**

"Send Them Your Inquiries"

**as they are at your service for
specifications, drawings,
estimates and
prices.**

**Satis-
faction as-
sured on all or-
ders and deliver-
ies made promptly.**

Remember the Address: COR. KENT AND SLATER STS., OTTAWA, ONT.

Hubbell Plugs

Will Help You Sell
More Electric Fans

NOW is the time to stock up with Hubbell Plugs and clean up the profits. Equip your Fans with Hubbell Plugs and insure your customers the best Fan service.

Hubbell Plugs are the easiest to sell because easiest to use. The Interchangeable Push-In Cap prevents twisting of the current cord. The Cap fits all Hubbell Plug and Receptable Bases.



Hubbell Plugs cost no more and do much more than other Plugs. They are handy to get at—neat to look at. They'll do you a good turn at every turn.

Hubbell Plugs will bring Fan customers to you and hold them for you. You can coax customers your way by making use of our

**Special Advertising Literature Free
to Dealers and Central Stations.**

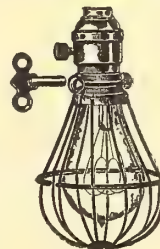
Send your order for printed matter. *You're welcome to all you can use.*

R. E. T. PRINGLE

MONTREAL TORONTO WINDSOR

McGILL LAMP GUARDS

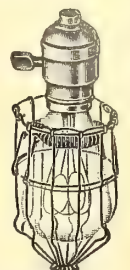
AND
PORTABLES



LOXON



STYLE "D"



STYLE "H"



NATIONAL

Cut down lamp bills by
protecting lamps from

Theft and Breakage

also prevent fire from hot
or broken lamps.

The four guards shown are
all leaders in service as well as
in sales. They represent just
a part of the complete McGill
line of Protector and Port-
able Lamp guards and
Electrical Specialties.

Send for catalog of line.

Carried by all Canadian Electrical Dealers.

McGILL MFG. CO.

5 OAK ST., VALPARAISO, IND.

"Devoe" Iron Form Boxes

The Cheapest and Best



We carry the largest stock of form boxes in Canada.

We have now in stock the following sizes:

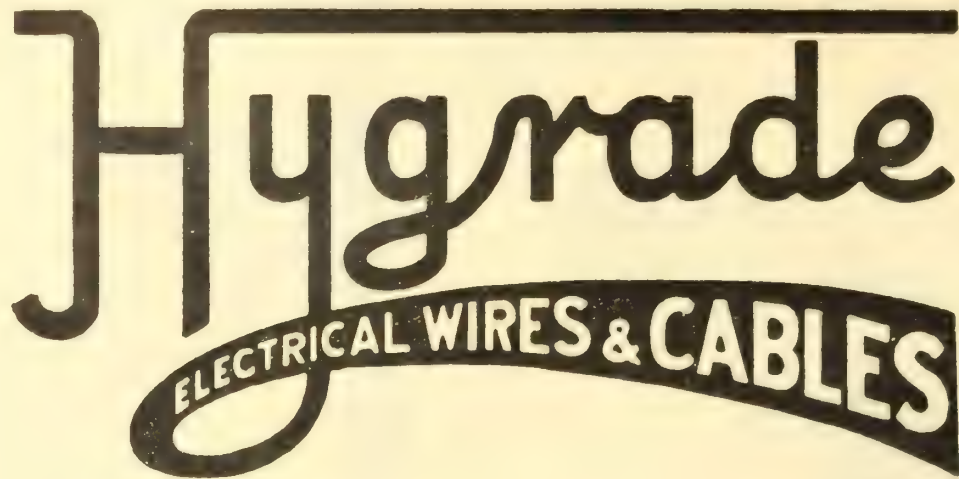
6 x 16 x 4	10 x 18 x 5
6 x 8 x 4	18 x 18 x 5
10 x 12 x 4	18 x 24 x 5
12 x 12 x 4	18 x 30 x 5
12 x 18 x 5	9 x 16 x 4
12 x 24 x 5	7 x 22 x 5

Write to-day for Detail Circular and Prices

The Devoe Electric Switch Company

Office and Factory:

157 Craig St. W., Montreal



Copper Aluminum Iron

Weatherproof Insulated and Bare

For
Telegraph, Telephone, Lighting
Power and Street Railway Circuits

Galvanized Steel Strand for Guys

Canada Wire & Cable Co.

Limited

Eastern Sales Office and Warehouse
Roper Clarke & Co., Limited
422 Coristine Building, MONTREAL

Head Office and Factory
1160-1170 Dundas Street
TORONTO

One Central Station Has Installed 157 Hughes Electric Ranges

and has built up a total connected stove load of 500 K. W. An increase of only 80 K. W. in transformer capacity was necessary to handle this load, as experience has shown that stoves add little to the evening peak.

The average monthly cost of current per consumer and including hotels, restaurants, boarding houses, etc., has never exceeded \$3.09.

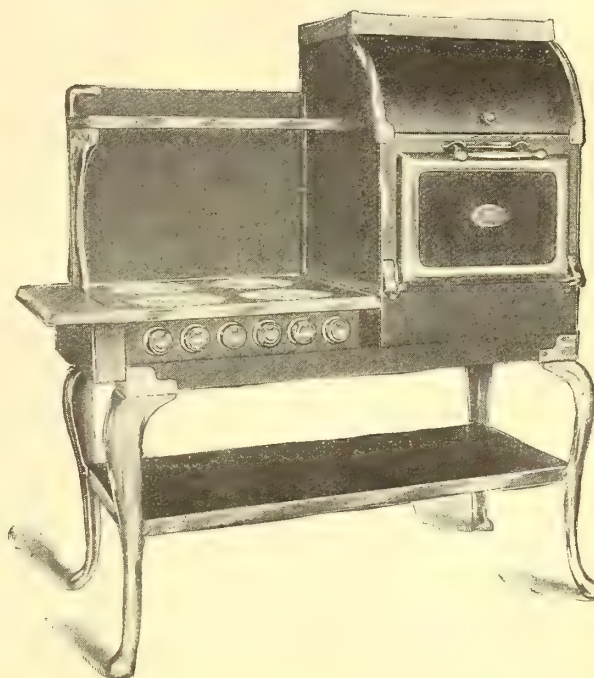
This is the biggest electric range installation in the world. If you'd like to learn more about it, just write to

Hughes Electric Heating Company

226-8 W. Superior St.

Chicago, Ill.

Can be procured in Canada through either
Roper Clarke & Co., 422 Coristine Bldg., Montreal, Que. or
The James Stuart Electrical Co., Winnipeg, Man.



NEWTYPE BERGMANN LAMPS

(Tungsten Filament)

The Unbreakable Kind

Are Now Ready for Delivery

We guarantee delivery to you in good condition

EXCLUSIVE CANADIAN DISTRIBUTORS

P. H. KLEIN, Jr., CO.

329 CRAIG STREET WEST
MONTREAL, P. Q.

LIVE AGENTS WANTED ALL OVER CANADA



Induction

Long Life Bearings
High Power Factor
Great Overload Capacity
Conservative Rating

The manufacturers of induction motors may be divided into two schools:

Those who prefer the "open slot" construction and those who build under the "closed slot" principle. Each of these contends that their extreme is better than the other. The "open slot" advocates sacrifice electrical qualities to mechanical convenience. The "closed slot" adherents gain the highest electrical advantages, but have a motor which is very inconvenient mechanically.

By means of the special arrangement of the end-rings shown in the illustration, connections of uniform electrical resistance are provided, and all tendency toward local heating or concentration in one ring is avoided.



Motors

Generators

Transformers

Motors

Extra Strong Starting Torque
Unusually Heavy Insulation
Convenience of Repairs
Efficient Ventilation

In the C. W. motor the slots are first made open, allowing plenty of space for the inserting of heavily-insulated form-wound coils, and are then closed by magnetic wedges which give all the electrical advantages of "closed slot" construction. The cut shows how the magnetic wedge "E" increases the distributing area of the tooth and allows the flux to travel a shorter path than is the case where the wood-wedge "P" is used.

For a further discussion of this subject and other interesting advantages of these motors write for induction motor booklet "E."

The C. W. motor has more bars in the rotor than any other similar motor. This results in minimum flux leakage and high torque. This is why it takes a greater overload to stop a C. W. Motor.

Canadian Crocker - Wheeler Co.

Manufacturers and Electrical Engineers

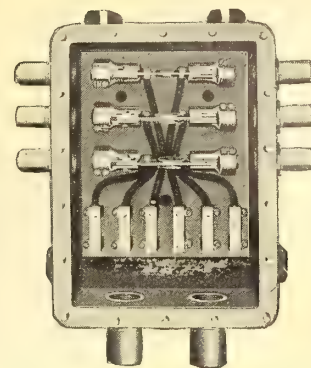
LIMITED

HEAD OFFICE AND WORKS: ST. CATHARINES, ONT.

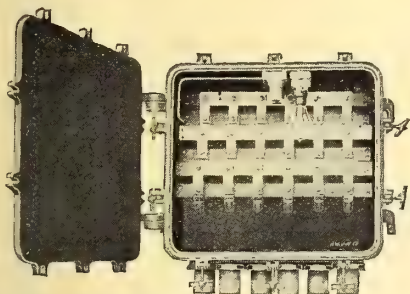
BRANCH OFFICES: MONTREAL, QUE.
TORONTO, ONT. VANCOUVER, B.C.

A "NOARK" SUBWAY BOX to Meet Your Needs

"NOARK" Subway Service Boxes are made in a variety of styles, and no matter what your requirements may be, there is one of them which exactly meets your needs. These boxes are absolutely watertight. They have a type of cable union so designed that cable connecting becomes an easy matter. The covers are held in place by $\frac{1}{2}$ -inch steel rod studs, and are easily replaceable should they become broken.



"NOARK" 3-Pole (D. B.)
Subway Box 150-Amp.,
250 Volts



"NOARK" 6-Way Subway Box

"NOARK" Subway Boxes have extra heavy cast iron feet and covers, which prevent the possibility of breakage either in shipment or during installation.

Our Engineering Department is prepared to design Subway Service Boxes to meet any service condition.

Write nearest Branch as to your requirements

The Canadian H. W. Johns-Manville Co., Limited

Manufacturers of Asbestos
and Magnesia Products

ASBESTOS

Asbestos Roofings, Packings,
Electrical Supplies, etc.

TORONTO, ONT. MONTREAL, QUE. WINNIPEG, MAN. VANCOUVER, B.C.

Monarch Electric Company, Limited

St. Lambert, P.Q.

DISTRICT MONTREAL

Phone: Main 3988
Montreal Exchange



500 Amp. 6,000 Volt Automatic
Oil Circuit Breaker Laminated Con-
tacts Individual Oil Tanks. Can be equip-
ped for remote control.

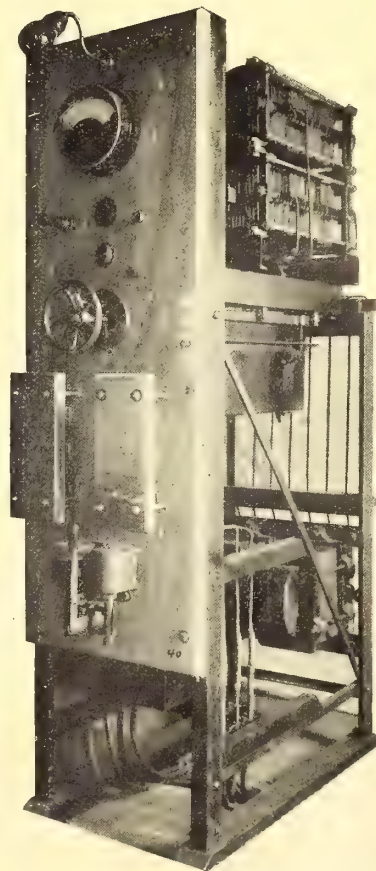
We
manu-
facture

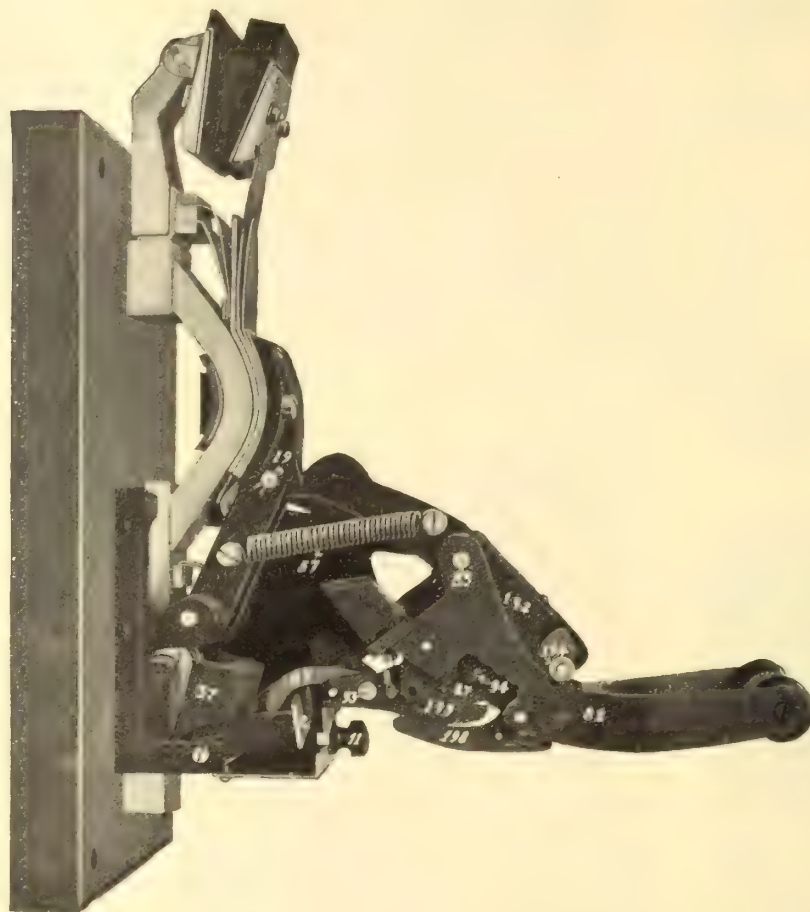
**Electrical
Specialties,
Switchboards,
Switches**

Special Transformers

and numerous other Electrical Ap-
pliances but space prohibits enlarging
on them in this issue.

300 H.P. 2500 VOLT MOTOR STARTING EQUIPMENT





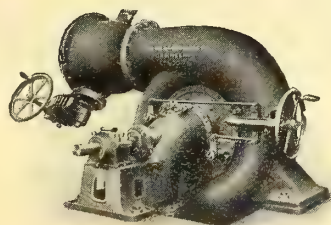
L. L. Autoite (Non-closable on Overload) Type with housing partly broken away to show working parts, full details in our new Hand Book of the I-T-E Circuit Breaker.

One of our customers recently referred to the switchboard as the heart of the electrical installation; doubtless this is so, but it is even more true to state that the Circuit Breaker is the heart of the switchboard problem. The Circuit Breaker must be as accurate as an ammeter and it may be called upon to operate on overload or short circuit conditions many times a day; the mechanical strain and shock to which it is subjected is enormous; it follows that it must be correctly designed and self-protective. The Circuit Breaker is where the wear and tear comes; Consulting Engineers knowing this, always give their preference to I-T-E.

THE CUTTER COMPANY, Main Office and Factory PHILADELPHIA

W. C. Jessup, 120 Liberty Street, New York City.
 H. F. Darby, Jr., 1555 Monadnock Block, Chicago, Ill.
 H. W. MacVaugh, 1122 Park Building, Pittsburgh, Pa.
 Thos. E. Beasley, 751 Ellicott Square, Buffalo, N.Y.
 C. E. Wise, 427 Ford Building, Detroit, Mich.
 Eccles & Smith Co., 71 First Street, San Francisco, Cal.
 Eccles & Smith Co., 524 S. Los Angeles St., Los Angeles, Cal.
 Eccles & Smith Co., 68 First Street, Portland, Ore.
 Electric Manufacturers' Sales Co., Tramway Bldg., Denver, Col.
 I-T-E Electric Co., 72 Finsbury Pavement E.C., London, Eng.

Water Power Plant



Type 30 Francis Turbine
1000 B.H.P. 120 Feet Fall

Pipe Lines, Governors, etc.

Apply to

James C. Gordon & Co.

81 and 83 Knightbridge Street

LONDON, - - ENGLAND

Ornamental Standards



**Poles
Mast Arms
and
Brackets**

**Over Head
Line Material**

SEND FOR CATALOG
AND DESIGNS

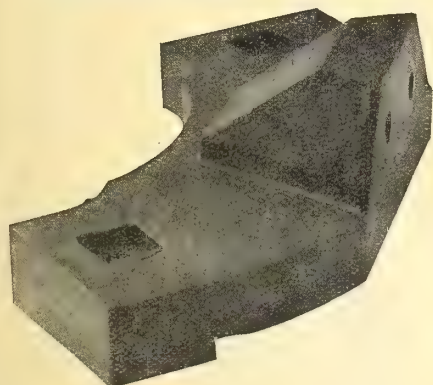
**Dawson & Co.
Limited**
Montreal and Winnipeg

Canadian Moulded Electrical Insulation



Moulded Relay Tops

Bakelite



Moulded Brush Holder Yokes

Canadian Product throughout,
manufactured from Raw Mat-
erial to finished article in Can-
ada.

Bakelite insulation combines
high dielectric properties, ex-
treme strength and toughness.

Not affected by chemicals, temperature changes and
weathers indefinitely.

Can be moulded into almost any form to suit require-
ments. With or without metal inserts. *Write us.*



Moulded Dash
Pots



Moulded Expul-
sion Fuse Insul-
ators



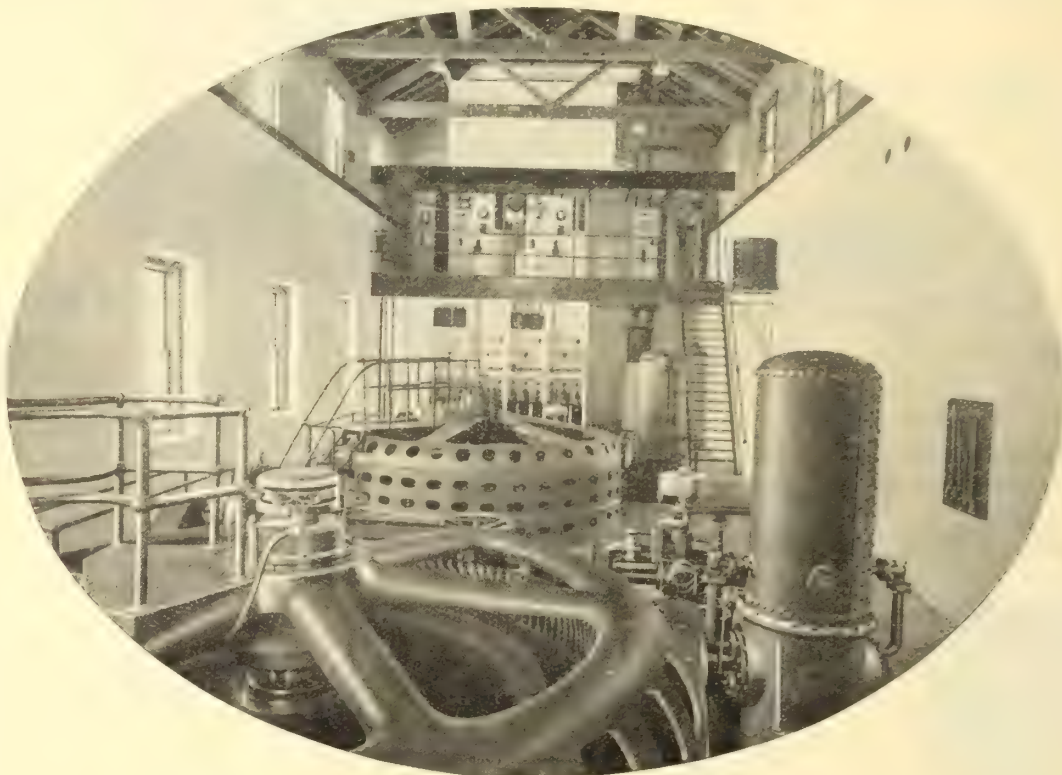
Moulded Pot Heads

PLASTICS LIMITED - Van Horne Street, Toronto

WE ARE THE **ONLY FIRM** IN **CANADA** WHICH BUILDS COMPLETE

HYDRO-ELECTRIC POWER PLANTS

Both Turbine and Generator are constructed and tested under the Supervision of the engineers who designed them and who are thoroughly familiar with the conditions necessary for their successful operation as one unit.
With a given amount of water **we guarantee** a definite electrical output.



MUNICIPAL POWER PLANT, NELSON, B.C.

INCLUDING WATER WHEELS, GENERATORS, SWITCHBOARD, MOTOR-GENERATOR,
TRANSFORMERS AND OTHER AUXILIARY APPARATUS BUILT
IN OUR SHOPS AT MONTREAL

ALLIS-CHALMERS-BULLOCK LIMITED

MONTREAL: 612 Canadian Express Bldg.
TORONTO: 810 Traders Bank Bldg.
CALGARY

WINNIPEG: 601 Builders' Exchange Bldg.
VANCOUVER: Dominion Trust Bldg.
COBALT



Sign Receptacles For Electrical Sign Makers

No. 29 is a **self holding** receptacle, strongly made and sheet metal holder. It requires only a plain **round** hole in sign and thus it is more easily and quickly adjusted. Another point is the fact that the making of plain **round** holes is easier on your punches and makes them last longer than if the hole were notched.

No. 988 is a two piece sign receptacle which is now furnished with Mica, insulating point of contact from lamp shells. A thoroughly reliable receptacle of "Duncan Quality."

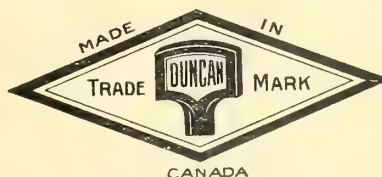
Order from your dealer and if he doesn't stock them write us. Get our new catalogue for your file. It shows many electrical supplies, all of "Duncan Quality."

The
**Duncan Electric
Company, Limited
MONTREAL**

**Makers of Electrical Supplies
bearing this trade mark**



No. 988



No. 29

Now is the Time to Place Your Contracts for Fans



60" Ceiling Fan

We have in Toronto a complete stock of the famous MARELLI FANS, and are well equipped to fill your orders for both A. C. or D. C. Fans.

Special Discounts on Future Delivery Orders



12" Desk Fan

Chapman & Walker, Limited

Head Office : 69 Victoria Street, TORONTO, ONT.

MONTREAL, QUE.
106-107 St. Nicholas Bldg.

WINNIPEG
395 McGreevy Block

Branch Offices :
VANCOUVER
Imperial Block

CALGARY
General Supplies Ltd., 1232 Second St. E.

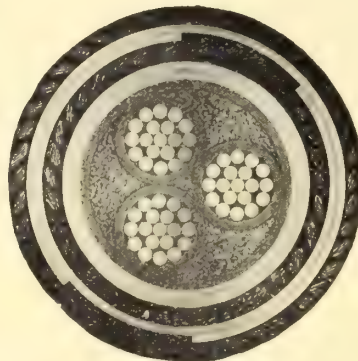
PORCUPINE
J. P. Bartleman

V. I. R. Cables

Wire, Flexible

Paper Insulated
Lead Covered
Cables

Telephone Cables



.075 sq. in. three core, circular
lead covered, steel tape
armoured cable

MONTREAL AGENTS:

Alexander Macpherson & Son,
Montreal, Que.

Vulcanized Bitumen Cables

Transmission
Lines

Trailing Cables

TORONTO AGENTS:

Chapman & Walker, Limited
69 Victoria Street
Toronto, Ont.

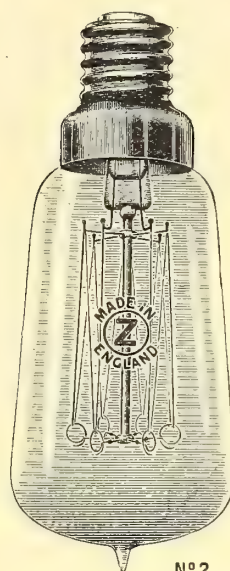
W. T. Henley's Telegraph Works Co. Limited

Contracts taken for complete Cable Systems installed

"Z" LAMPS



N°1



N°2



N°7

One of the greatest troubles with Tungsten Filament Lamps, a black deposit on the glass, has been successfully overcome in "Z" **Tungstens** by coating the stem of the lamps with **Phospham** which chemically absorbs the black deposit given off by the filament, thus keeping the bulb as clear as a new lamp. All "Z" lamps are fitted with **Standard Vitrite Insulate Bases**.

We have always in stock or on transit over 100,000 Carbon and Tungsten Lamps, which insures prompt delivery the same day as order is received.

Chapman & Walker

ENGINEERS AND CONTRACTORS

Head Office: 69 Victoria Street, Toronto, Ont.

MONTREAL, QUE.
Branch Office
406-407 St. Nicholas Bldg.

WINNIPEG
150 Princess St.

VANCOUVER
Branch Office
Imperial Block

CALGARY
General Supplies, Ltd.
1233 Second St., E.

PORCUPINE
J. P. Bartleman

Stock Carried in Montreal, Toronto, Winnipeg, Calgary and Vancouver

STERLING TELEPHONES

BRITISH MADE

STRONG & RELIABLE

**"Unitype"
and Annunciator**
In Drawn Metal Case (dull black)



No. C 6197 (actual size)

Each movement a complete unit and can
be mounted up in any number or
design to suit circumstances.

AGENTS (with Stock)

MANITOBA

The James Stuart Elec. Co.
Winnipeg Limited

ONTARIO

Chapman & Walker, Limited
Toronto

SASKATCHEWAN

Northwestern Electric, Ltd.
Regina

BRITISH COLUMBIA

Walker & Ure
527 Dunsmeir Street, Vancouver

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General Supplies, Limited
1233 2nd Street East, Calgary

QUEBEC—Stocks kept by

Dawson & Co., Limited - Montreal

Munderloh & Co., - - - Montreal

Mechanics Supply Co.,
St. Paul, Quebec (Que.)

NOVA SCOTIA—Stocks kept by

J. Starr, Son & Co., Limited, Halifax

Heating With Exhaust Steam

The Most Profitable Load an Engine Carries

Many of you are manufacturing heat in the form of steam, but what becomes of it? You are simply converting 10 to 14 per cent. of it into mechanical energy in the form of electricity, and throwing the balance away, either into the atmosphere or into the condenser.

The plant which operates non-condensing may have 10 per cent. heat efficiency and the condensing plant a possible 14 per cent. conversion.

Why Not Sell the Larger Amount of the Otherwise Lost Energy

You can get a price for it which will pay the total fuel bill of the plant, including also such other expenses as water, oil, etc.

CAN IT BE DONE? YES!

Others are not only doing that very thing, but are also earning interest and depreciation on the cost of the steam installation.

*We not only Make Reports and Build Central Station Plants,
but Solicit Business and Manage Such Plants, if Required.*

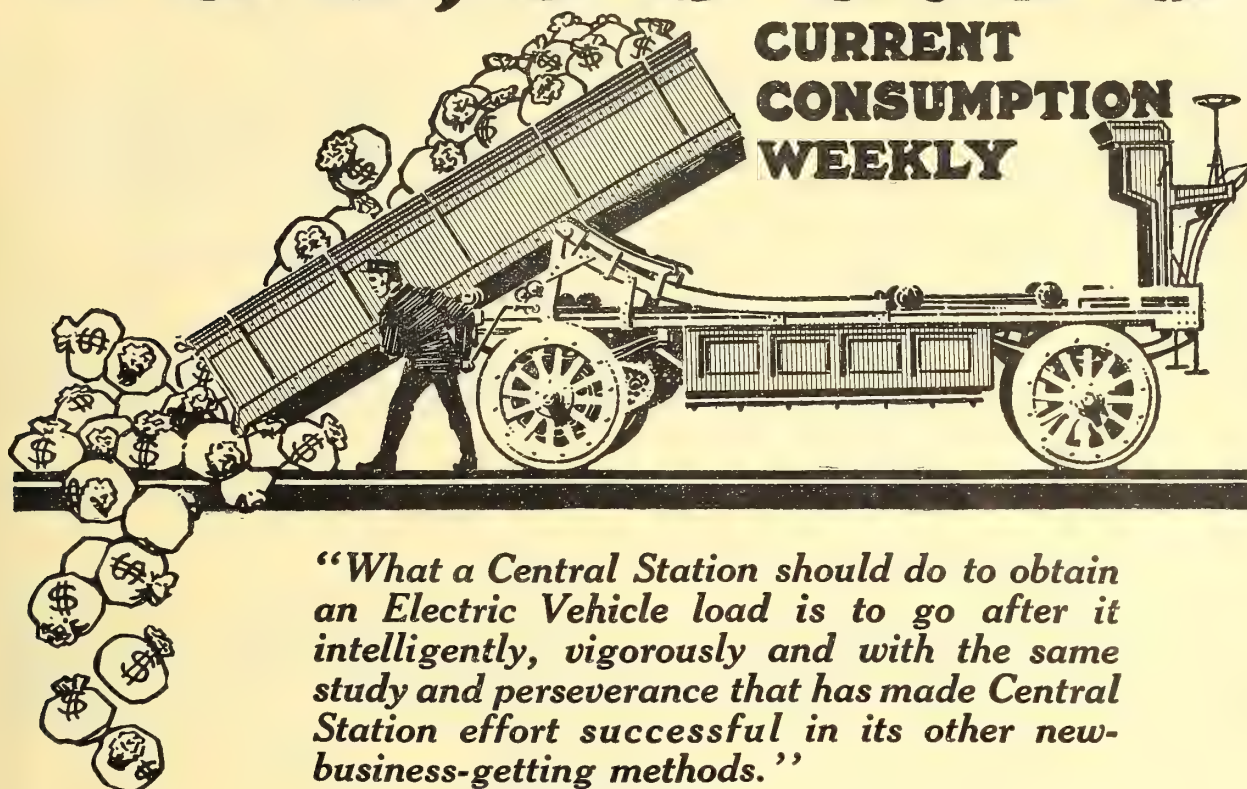
Why Not Take Advantage of Our Experience?

Central Station Heating & Construction Co.

714 Ellicott Square, BUFFALO, N. Y.

Canadian Office: W. E. SKINNER LIMITED, Somerset Building, WINNIPEG

\$90,000.00



"What a Central Station should do to obtain an Electric Vehicle load is to go after it intelligently, vigorously and with the same study and perseverance that has made Central Station effort successful in its other new-business-getting methods."



This statement was made at the first annual meeting of the Electric Vehicle Association of America. It is as indisputably true today as it was then. Every Central Station in the country should increase its revenue through the sale of current for Electric Vehicles.

Only two years ago the 7,000 Electric Trucks then in use meant an average income of \$30,000.00 a week to the Central Station industry. Now there are over 20,000 Electric Trucks in active operation—and they consume \$90,000.00 worth of current each week. And mind you, these figures are based on the current consumption of trucks *only*. No estimate is made of the current consumption of the great number of pleasure cars.

Why Not Get Your Share of This Profitable "Valley Load" Business?

Are you doing your share to popularize Electric Vehicles? We are conducting a nation-wide advertising campaign for the Electric, both pleasure and commercial, in a great number of national magazines and a long list of trade journals. We want every Central Station in the country to derive the greatest possible amount of individual benefit. Just get in touch with us today and we will tell you how you can ally yourself with this concentrated effort to push the sale of Electrics.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA

BOSTON

NEW YORK: 124 W. 42nd St.

CHICAGO

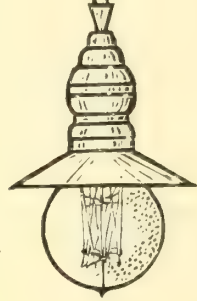
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Drawn-Wire "Kolloid Wolfram"

TUNGSTEN LAMPS

Reduction in Price

Quality Improved Delivery Prompt
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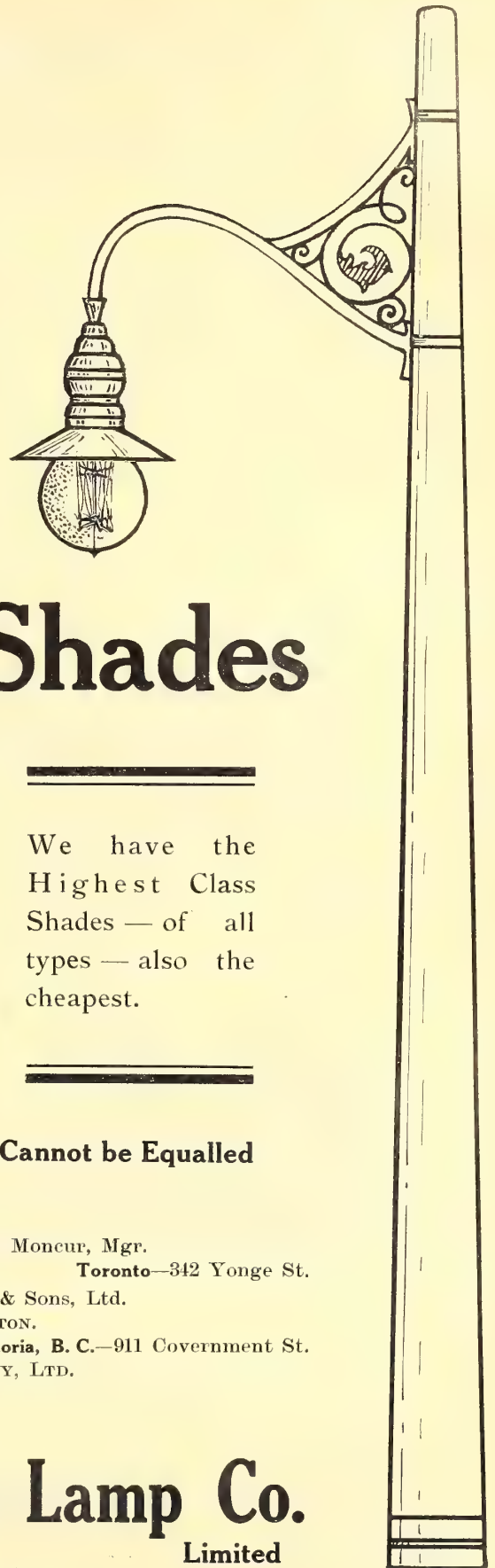
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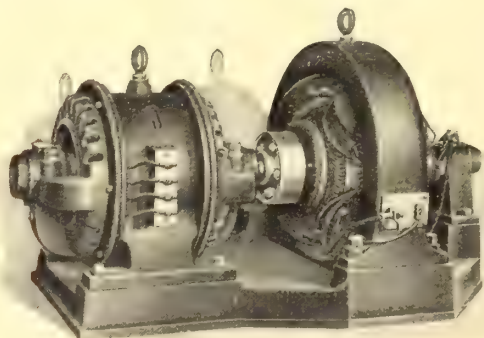
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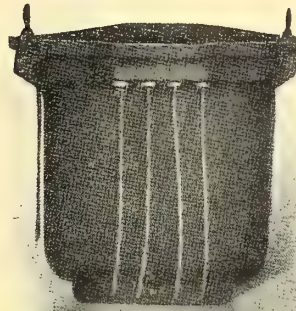
Write for new and complete catalogue No. 3.

Central Electric & School Supply Co., Limited

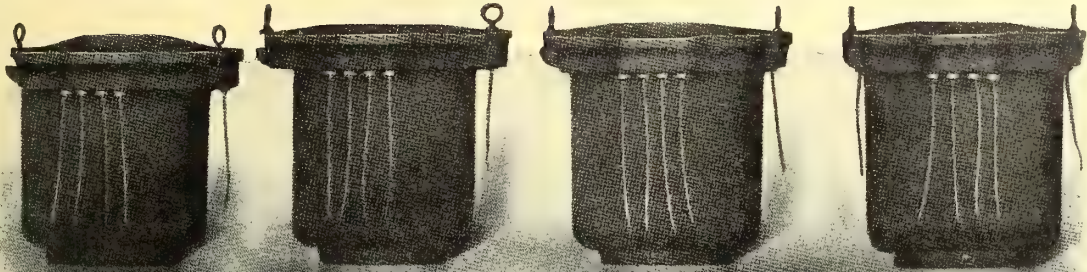
36 Adelaide St. West, Toronto

PACKARD

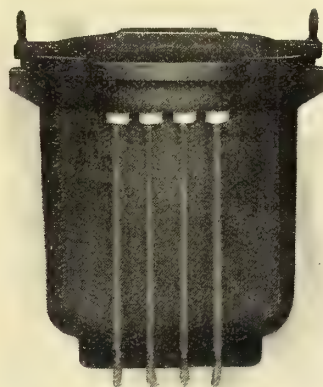
Distributing



Transformers



Light



Power

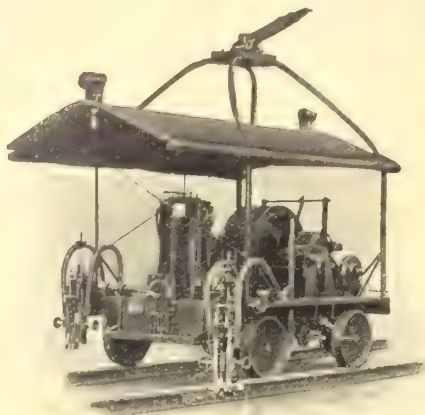
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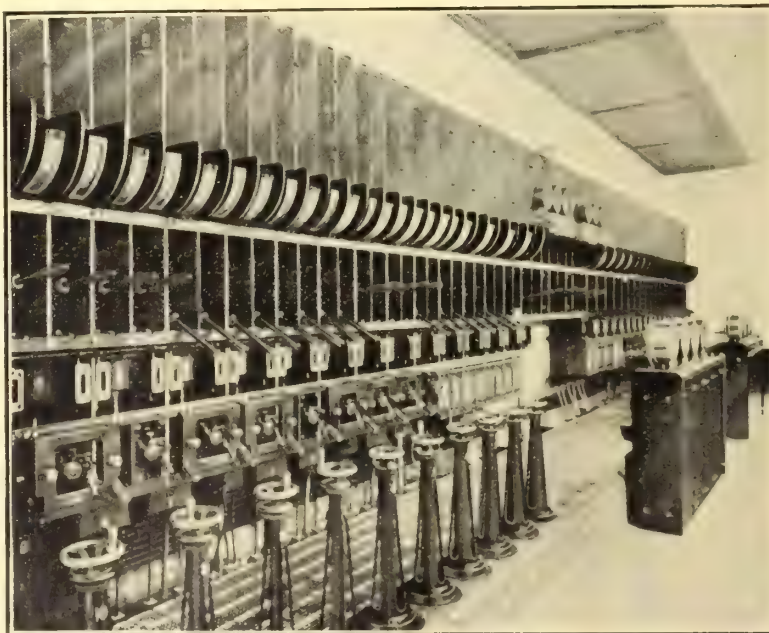
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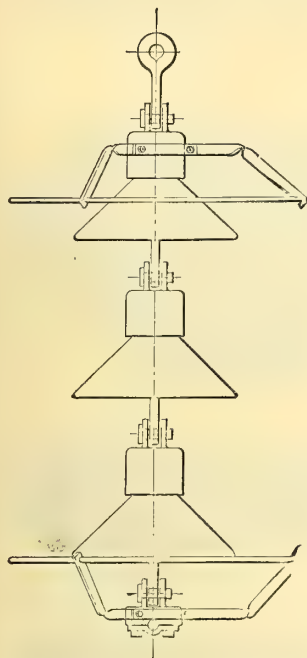
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THE NICHOLSON ARCING RING is a protective device for high voltage insulators. It consists of iron rings, one at bottom of the insulator, grounded to the cross-arm and one at the top connected to the line and an arc over the insulator is carried by these rings, avoiding burning off the line and avoiding cracking and destroying the insulator because the heat of the arc is removed from the insulator.

It is a simple but very effective device. Several lines are equipped and after lightning flashover has opened the breakers, the line, upon closing, is found to be intact and alive. This is a great satisfaction and a great economy.

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It can readily be applied to either pin type or suspension insulators.

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OR

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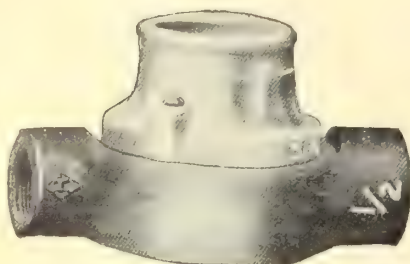
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324 Smith St., Winnipeg, Man. **Limited**

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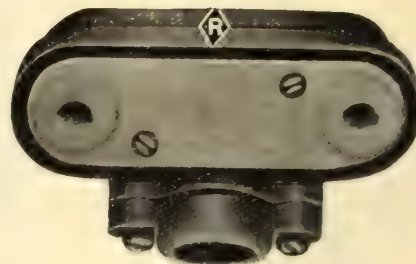
For Every Electrical Purpose



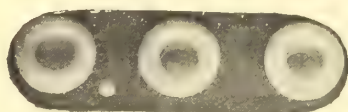
G with Receptacle



LR 3 Wire



F 2 Wire



1/4 in. No. 403



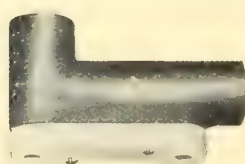
3/8 in. No. 403



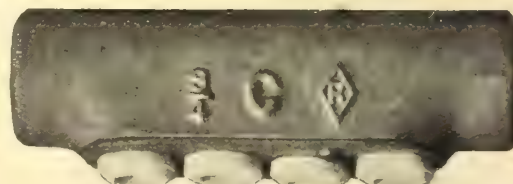
1/2 in. No. 303



1 in. No. 504



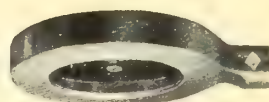
LB 2 Wire



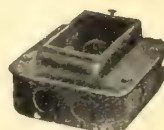
C 4 Wire



A 3 Wire



P 1 1/2



No. 1915 Switch Box



K 1/2



U 1/2



H 1/2 5 Amp.



T 2 Wire



FD 1/2



E 3 Wire

ELECTRICAL FITTINGS CO., LIMITED

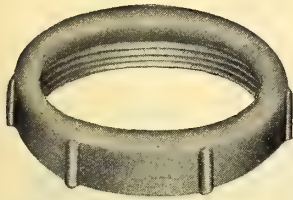
70 King Street West, TORONTO, Canada

British Columbia Agents:—Cope & Son Limited, 132 Water Street, Vancouver, B.C.

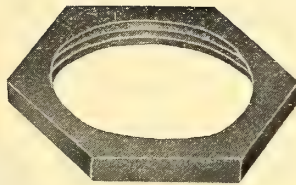
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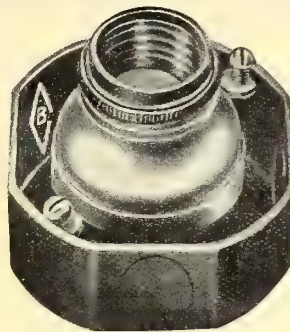
Electrical Supplies



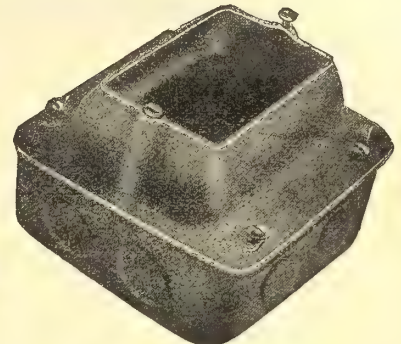
1 1/4" Bushing



1 1/4" Locknut



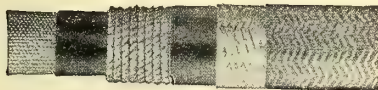
No. 6350—Box and Receptacle



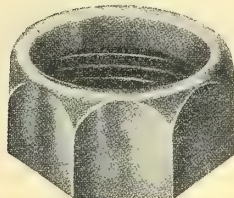
No. 1915—Box and No. 3719—Cover



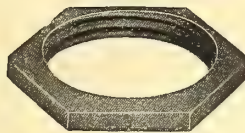
1455—Reversible Guard



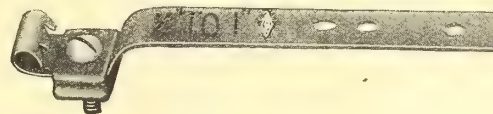
Alphaduct



1/2" Bushing



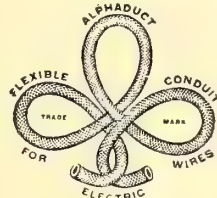
1/2" Locknut



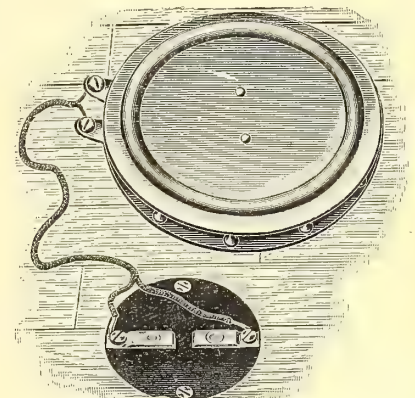
1/2 to 1" Grounding Clamp

81 A 3/8
Fixture, Stem

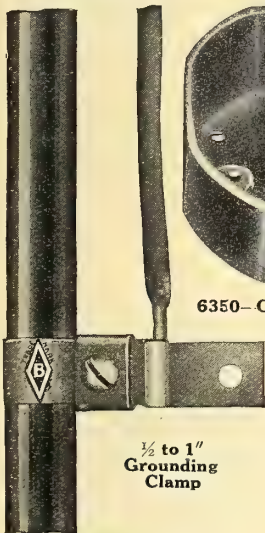
Pipe Strap



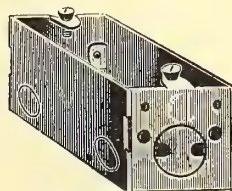
Alphaduct 1/4"



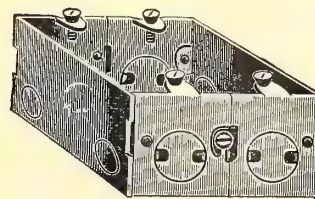
1150—Floor Tread

1/2 to 1"
Grounding
Clamp

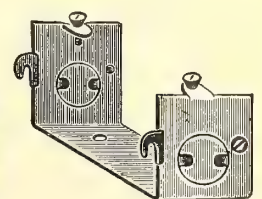
6350—Outlet or Junction Box



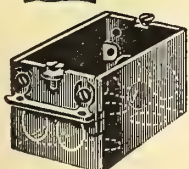
170—Comb Switch Box



172—2 Gang



171—Spacer



C C S. I. Switch Box

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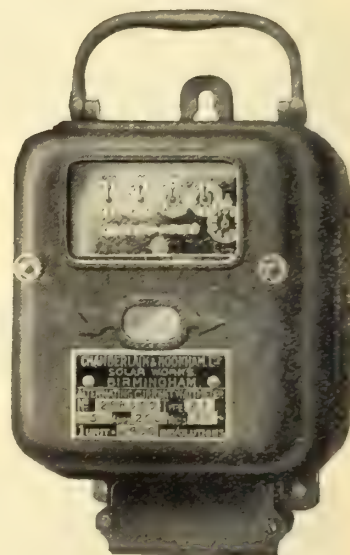
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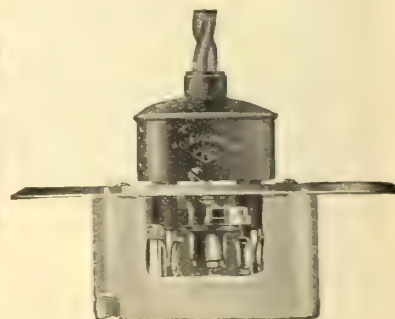
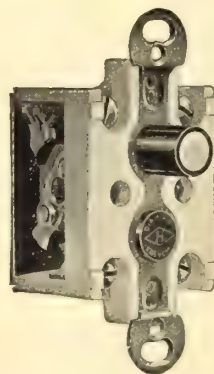
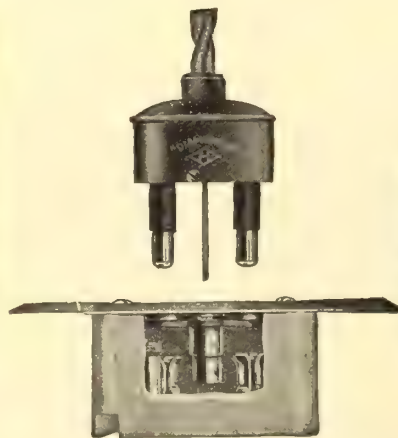
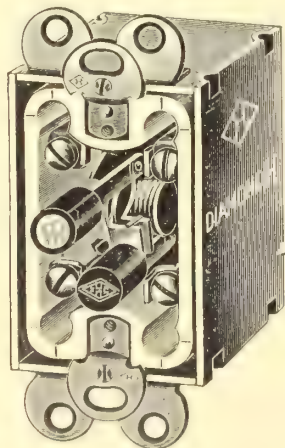
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Protect Your Investment in Switches by Specifying "Diamond H"

The best protection for the user because they are dependable in operation. The safest investment for the dealer, engineer or contractor because they give satisfaction.



The "Diamond H" on a switch is valuable insurance—assurance that quality, materials and competent workmanship are embodied to perfect production.

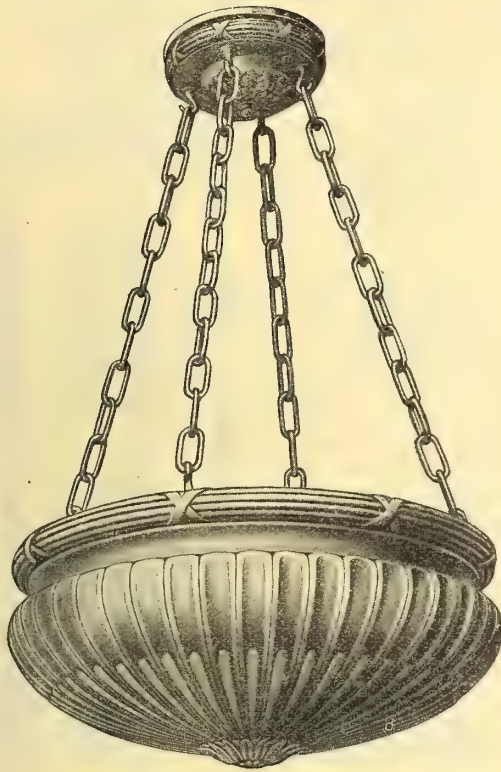


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Patents have been granted on the **Economy Renewable Fuses** for Canada and Great Britain.

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Economy Fuses are guaranteed to operate according to ratings, and meet specifications of the National Board of Fire Underwriters.

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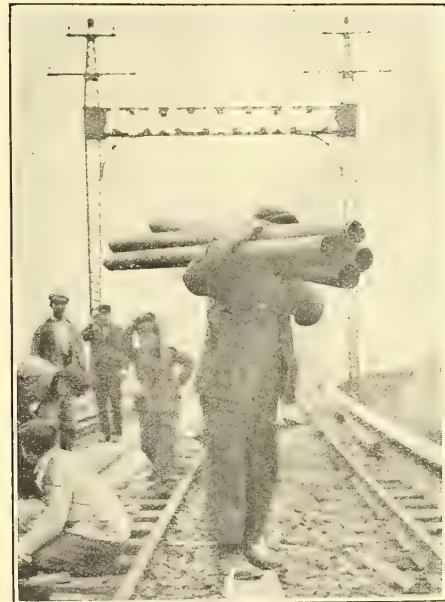
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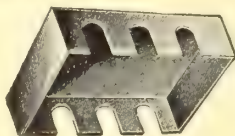
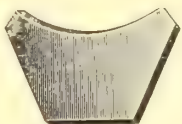
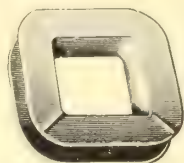
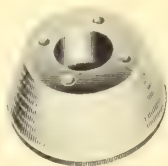
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Sockets with Pendent Cap

P. & S. 61217 is almost too well known to require very much, if any, comment.

The mechanism has recently been improved so that longer life and snappier action of the key is secured.

We have just issued a bulletin showing this socket and some new ones, bulletin No. 732, which will be sent on application.



Sockets with Pendent Cap

P. & S. 61317 key porcelain socket is particularly adapted for the use of New Code cord required by the Underwriters.

The shape of the cap has been changed a trifle so it is easier than ever to wire up.



Sockets with 1-4 Inch Cap

P. & S. 434 key or **435** keyless is a late addition to the **P. & S.** interchangeable sockets.

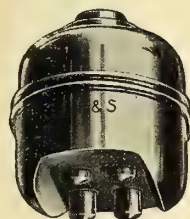
The cap is polished brass but brush brass will be supplied without extra charge.

The same snappy interchangeable mechanism is used in this socket as in the entire line of **P. & S.** porcelain key and keyless sockets.



Pendent Switches

Your attention is directed to the illustration of **P. & S. 3000**. A slight change has been made in the shape of the push buttons. They are round instead of square as in the past.



Two-Circuit Pendent Switches

P. & S. 3002 is a pendent switch containing two individual mechanisms so that two circuits or groups of lights may be controlled from the one switch.

The list price on this switch has recently been reduced. Your jobber will be glad to give you the new list price.

P. & S. products are now carried in stock by several jobbers throughout the Dominion of Canada and if yours does not carry them in stock, drop us a line and we will tell you where you can get them.

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178 Fulton Street, NEW YORK CITY 700 West Jackson Blvd., CHICAGO, Illinois
DENVER SALES AGENTS—B. K. Sweeney Electrical Co.

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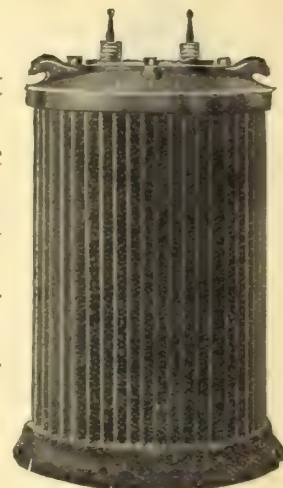


Not the cost of purchase and installation, but the cost of upkeep and copper loss.

Moloney Transformers, owing to the high grade Silicon Steel used in their core and to their perfect design, have reduced core loss to a minimum.



Moloney Transformers will effect a saving of 20 per cent. in one year over ordinary transformers, and in five years the price of a new transformer. This is not an empty statement but a proven fact.



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Canadian Moloney Electric Co.

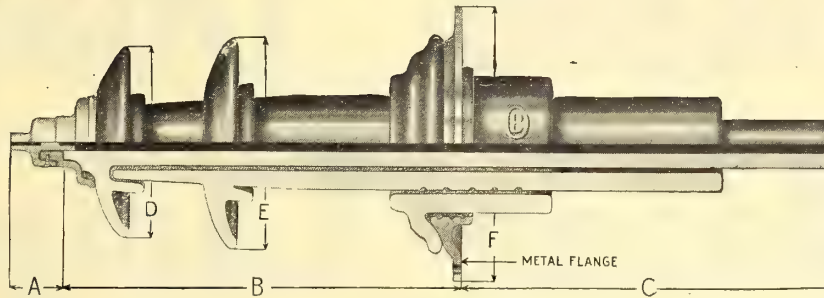
Office and Works: WINDSOR, ONT.

Limited

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A. Ross Osborne, 616 Continental Life Bldg., Toronto, Ont. Hinton Electric Company, 606 Granville Street, Vancouver, B. C.

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Ample proof of the service efficiency of O-B Hi-Tension Wall and Roof Insulators is shown by the fact that of the hundreds of these Insulators in service under all kinds of conditions—

Not a Single Failure Has Occurred

Complete Line for All Voltages and Service Conditions

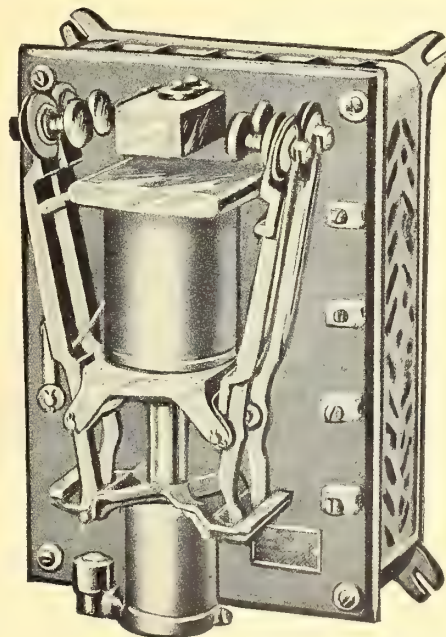
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SUNDH SOLENOID MOTOR STARTERS

Compact and reliable starter for Direct Current. No sliding contacts.

The advantages of this type of construction are not only simplicity and easy replacement of wearing parts, but also the elimination of sliding contacts which cause trouble due to arcing and consequent sticking of the moving member.

The construction of the Sundh Automatic Starter is compact and simple, consisting of a solenoid, a plunger with retarding dash-pot, and two or more levers hinged to the lower pole-piece of the solenoid.



The upper ends of the levers carry the contacts. The levers are controlled by their lower ends passing through a frame which is attached to the bottom of the plunger. The contacts are of copper and carbon, and all wearing parts are accessible and easily replaced. For heavy duty the final contact is made by a laminated copper brush. This copper brush, however, does not cut out any resistance, but merely short-circuits the carbon contacts which do cut out the resistance.

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Steel Transmission Structures

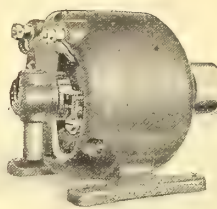


□ The cut shows the type of flexible "A" frames recently erected for a 34 mile line from St. Catharines to Hamilton. These are 47 feet high and 9 feet wide at the ground. Placed approximately 400 feet apart along the line.

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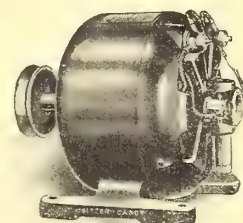
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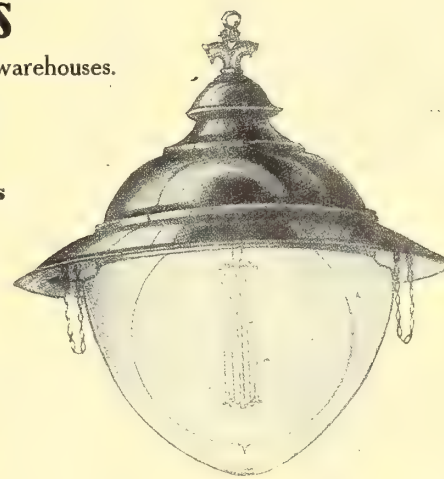
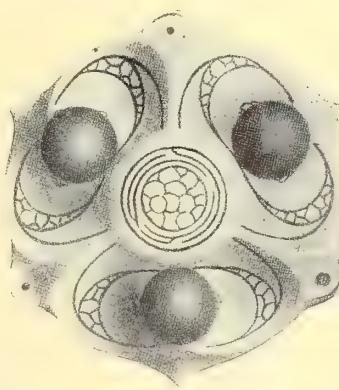
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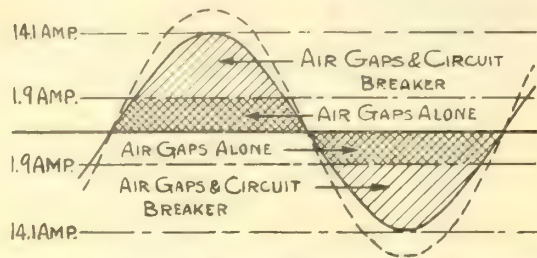
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Curve showing Graphically the Functions of the Air Gaps and the circuit Breaker in the Garton-Daniels Arrester

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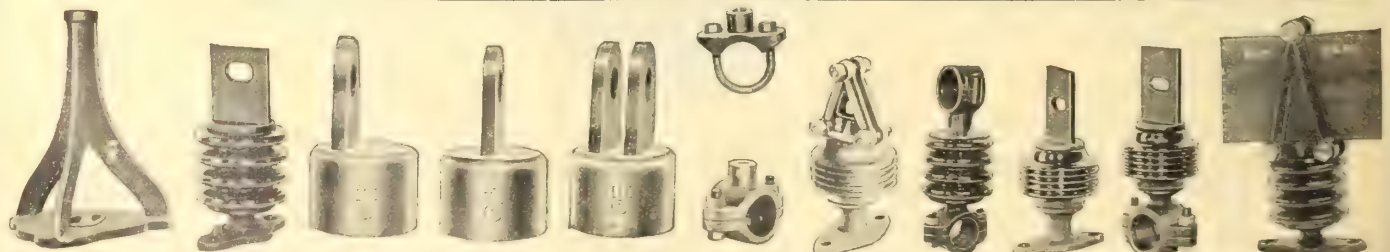
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Electrical News

Generation, Transmission and Application of Electricity

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Vol. 21

Toronto, July, 1912

No. 7

First Step Towards Taxation

By allowing the impression to go abroad that electric operation of the waterworks plant is more expensive than steam operation the Hydro-electric Commission of Toronto are taking an unfair advantage of the people's ignorance of a technical matter and incidentally are doing incalculable injury to the cause of municipal electric ownership and operation.

It will be remembered that the consent of the electors to instal such a plant was obtained on arguments and figures which showed that substantial saving would result from the expenditure. Either the engineers' calculations were faulty or the present management is bad. It does not look like an engineering error since other cities and towns are actually doing what Toronto promised to do, that is, operating at a less cost than with steam. Neither is it a case where the management is likely to be responsible for the high cost since it is a business that comes without solicitation and so resolves itself largely into a matter of operating.

The explanation must be found then in another quarter. It is understood of course that Toronto's distribution system has cost much more than was expected or than it should have cost. The revenue is not in any way proportionate to this cost. The only conclusion is, then, that the ratepayers are, indirectly, being deliberately and secretly taxed by means of this unnecessarily high water rate to assist in making up the interest charges on their own extravagant investment. In view of the oft-repeated assertion that this municipal plant would result in the gradual reduction of the general taxes the present condition of affairs can scarcely be looked upon with satisfaction.

Good Service Only Wins

It speaks none too well for the success of a municipal undertaking when those in charge take the ground that the people want to use their system,—good or bad,—the argument advanced in one of Toronto's suburbs recently where there was competition between the municipal and private plant. It is quite time that municipalities should cease to hold on to this evanescent idea that "the people" care a snap whose plant supplies them. What the people want is service, not sentiment. In the case mentioned above the company came on the field with a clear-cut, straightforward business proposition. The business course for the municipality would have been to meet or better this offer, but instead we find an alderman, a guardian of the ratepayers' interests, childishly arguing that the people want the municipal service at any cost.

The fact of the matter is, the citizens want municipal service only if it is better, or at least as good as any other offered them. When the first flush of enthusiasm is over the large majority of the electors will do business where they get the most satisfactory terms. While the municipality has been trading on the loyalty of its citizens the private company has been doing business—and none the less straightforward because it has been tremendously successful. Private competition in Toronto is easily twice as strong as it was three years ago and the chances of success of the municipal undertaking proportionately lessened. We do not venture an opinion on the ultimate outcome of the situation, believing there is room for the successful operation of both, but the municipal management had better stop calling names, sign up a couple of National League pitchers and "play ball." The cheers of the bleachers never won a game yet.

The Value of the C. E. A.

The Canadian Electrical Association has just held one of the most successful conventions in its history, in part as a result no doubt of its recently acquired affiliation with that commercial association in the United States known as the National Electric Light Association, but in large measure also as the more direct result of enthusiasm and loyal work on the part of a number of its most prominent members. The National Electric Light Association is, primarily, an organization including only private operating electric companies, banded together for mutual benefit and assistance. The useful work of this association is beyond question and almost incalculable in extent. They study "best methods" in the electrical business with results that have practically revolutionized, during the past ten years, the system of operation and management. The Canadian Electrical Association is now operated largely along the same lines and no man who is in any way connected with the commercial side of the electrical business in Canada can afford to miss the instruction it offers. Between the men who profit by this association and those who do not there is, in a degree, the same difference as between the trained and the untrained men in any other walk in life.

And right here, let me say, the municipalities show a weak point. They have no such organization. The electrical operators have no ready means of learning from one another or from others what are the best methods to pursue under certain new conditions. Each must gain, to a considerable extent, his own experience and this often, too often, costs the municipality dearly. Few municipalities have recognized the importance of constantly reorganizing their systems and methods to keep in touch with the best and latest practices. This lack of organization among electrical workers in municipal enterprises will constitute a big handicap as long as it exists.

Electrification of Mount Royal Tunnel

It will be many months before a decision is made as to the exact system of electrification to be employed in running the cars through the proposed Mount Royal tunnel of the C.N.R. Only comparatively little attention has as yet been paid to the study of this question, but it is almost certain that the third rail plan will be ruled out owing to climatic conditions. Mr. W. C. Lancaster, the electrical and mechanical engineer, has already ordered a very large quantity of apparatus for constructing the tunnel. This includes six electrical air compressors, two of them being the largest in Canada; these, manufactured by the Sullivan Machine Company of Chicago, will operate with 400 horse power, 3-phase, 60-cycle, 2200 volt synchronous motors. The remaining four air compressors, half the size of the others, will be supplied by the Canada Foundry Co. The compressors, with a capacity of 2200 cubic feet of free air per minute, will be used to drive the drills in the tunnel and for pumping purposes. When the work of construction is over the two largest compressors will be utilized in the yards for operating switches, testing air-brakes, etc. The C.N.R. have made a contract with the Montreal Light, Heat and Power Company for the supply of electric current.

Five electric locomotives have been purchased for use in the construction of the tunnel, which will be $3\frac{1}{4}$ miles long. From the yards to the city will be eight miles, and the whole of this will be electrified. As far as the model city, $3\frac{1}{2}$ miles from the city terminal, multiple unit trains, consisting of motor cars with trailers, will be used for suburban traffic; from this point to the yards electric locomotives for heavy traction, which will bring out the regular trains, will be employed. At the yards these electric locomotives will be replaced by steam. The stations will be about a mile apart.

Strength Tests of Cross-Arms

The United States Department of Agriculture have issued from their Forest Products Laboratory a pamphlet containing the results of recent tests made on cross-arms of various materials. The tests cover cross-arms of four species:—Douglas fir, short-leaf pine, long-leaf pine and southern white cedar.

It is pointed out in the introduction that cross-arms must resist forces which are variable in amount and direction. In a line the arms may be subjected to heavy loads under several conditions:

(1) If the wires on one side of a pole are broken, a heavy side pull comes on the cross-arm from the other side. This causes a severe stress in the pole, and, as will be shown later, the pole is more likely to be broken than the cross-arm.

(2) If the wires are heavily covered with sleet and there is a strong wind blowing, there is a pressure on the cross-arms, but here again the stress in the pole will cause it to fail before the cross-arm will give way. Similarly, in changes of direction in the line the sidewise pull of the wires is more severe on the poles than on the arms.

(3) If the cross-arms are at the same level in the line, they can receive no greater strains than those which may be imposed by the weight of the wires, and of adhering ice, and by wind pressure. If, however, the middle pole of three is higher than the poles on either side and the wires are tightly stretched, there is a strong downward pull on the cross-arms. A similar condition might result if a single pole were left standing in a line where the poles on either side had fallen.

It is not necessary to reproduce exactly these stresses in laboratory tests if one test can be devised to cover the most severe conditions and the resistance to the less severe estimated on the basis of that one test. A test was devised

in which the load was distributed along the arm, as it is in actual practice. In all of the tests the load was applied vertically for two reasons: First, because the arms are likely to receive their heaviest loads in this direction; second, because from the results it is possible to estimate the resistance of the arms to forces acting in other directions. The test used is also well adapted to show the influence of defects on strength.

Tests were made on a 200,000 lbs. Riehle universal testing machine, the arrangement of which is shown in the pamphlet. In conducting the tests an initial load of 250 lbs. was applied, the scale and wire were then adjusted to zero reading, the machine started (the head descending uniformly at the rate of .26 inch per minute) a deflection reading taken at 500 lbs. and at each increment of 500 lbs. until a perceptible weakening of the arm was noted, after which the load was read for each .1 inch deflection, and at points of sudden change, until complete failure or 4-inch deflection was secured. The behaviour of the arm during the test was observed carefully and the character and sequence of the failures described. Each arm was also weighed at the time of test.

A detailed summary of the results are presented in the paper and a short summary of average results is given in a second table, which we print below.

Species and grade.	Rings per inch.	Summer wood.	Sap.	Moisture.	Specific gravity, dry.	Bending tests.				Compression parallel to grain.
						Load at 1-inch deflection.	Maximum load.	Work to maximum load.	Total work.	
	Num-ber.	Per cent.	Per cent.	Per cent.		Pounds.	Pounds.	Inch-pounds.	Inch-pounds.	Pounds per square inch.
Douglas fir.....	20	40	0	11.5	0.479	4,050	7,590 (7,590)	5,990	15,730	7,090
Longleaf pine, 50 per cent heart.....	17.9	43.7	55	13.4	.542	4,463	8,984 (9,000)	6,888	14,595	5,425
Longleaf pine, 75 per cent heart.....	18.5	53	32	13.5	.627	5,220	10,180 (10,240)	7,800	18,370	8,950
Longleaf pine, 100 per cent heart.....	15.5	44	1	12.8	.627	4,770	9,782 (9,830)	7,970	18,543	8,940
Shortleaf pine.....	10.5	46	79	13.3	.516	4,460	9,240 (9,220)	8,400	16,510	7,390
Shortleaf pine, creosoted.....	11.2	49				3,841	7,649 (7,360)	6,084	14,325	5,770
White cedar.....	12	45	15	14.3	.364	2,800	5,200 (4,800)	3,150	6,930	4,700

† Values in parentheses are the estimated maximum loads for arms 4.10 by 3.16 inches in cross section (the average size of Douglas fir arms).

Tests were made of the comparative strength of the various species and grades of material with the following results:—

	Average maximum load.
Longleaf pine, "75 per cent. heart"	10,180
Longleaf pine, "100 per cent. heart"	9,780
Shortleaf pine	9,260
Longleaf pine, "50 per cent. heart"	8,980
Shortleaf pine, creosoted	7,650
Douglas fir	7,590
White cedar	5,200

It will be noticed that the arms with 75 per cent. heart are stronger than those with a 100 per cent., while those with 50 per cent. heart are weakest, and it is evident that other factors than the relative amounts of heartwood and sap-wood must have a determining influence on the strength.

In nearly all cases the principal failure was at the first pinhole from the centre, though in many cases the first failure was apparent as a cracking at the centre bolt hole. In view of these facts it is recommended that in grading or selecting arms particular attention be given to defects near the centre or near the first pinholes. Knots on the upper side of the arm near these points are especially to be avoided.

Steam Plant for Vancouver Island—A. C. B. Turbo-Generators—Fuel-Oil to be used

The British Columbia Electric Railway Company, Limited, has recently awarded the contract for a large steam auxiliary plant to meet the demands resulting from the growth of its business on Vancouver Island, where the company furnishes electric current for light and power in the city of Victoria and all adjacent districts.

The location of the plant will be near Tod Inlet along the interurban line now being constructed by the company through the Saanich Peninsula. This line is about 22 miles in length and extends almost directly north from Victoria. It passes through a rich country, well suited, on the one hand, for agriculture, and, on the other, for suburban residential purposes. With the opening of this line, the construction of which is now well advanced, the company realizes that great developments will follow both of a residential and industrial character, and to meet these demands has planned for the construction of the new plant, which involves an expenditure of over \$400,000.

The building in which the plant will be installed is to be of reinforced concrete, 170 by 140 feet in dimensions, and



The Heavenly Twins of the B. C. E. R. Co., Vancouver

one storey in height. The plans call for a structure up to date in every particular, and meeting in every way the peculiar demands for a station of the type. One of the features of the plant will be the great stack, which is to be 248 feet in height, with an internal diameter of 11 feet at the top, and 17 feet 5 inches at the base. The type of construction for this stack will be reinforced concrete. It will in general be similar to the two large stacks now used in connection with the Vancouver steam auxiliary plant, a view of which, showing the high stacks (commonly known locally as the "Heavenly Twins") is given in connection with this article.

The electrical units of the plant at present being installed, are two in number, each consisting of an Allis-Chalmers-Bullock turbo-generator of 2,000 kw. capacity with an exciter of 75 kw. capacity. The boilers used at the plant will be six in number, being of the Babcock & Wilcox type and of 480 horse power each. The contract covers the installation of Wheeler admiralty condensers, centrifugal pumps, etc.

Fuel oil will be used in the operation of the plant, this being the first time the company has adopted this form of fuel, and large 10,000 barrel oil tanks will be located near the building, two auxiliary oil tanks being also provided. The entire installation for fuel storage has been made in

accordance with the rules of the fire insurance underwriters.

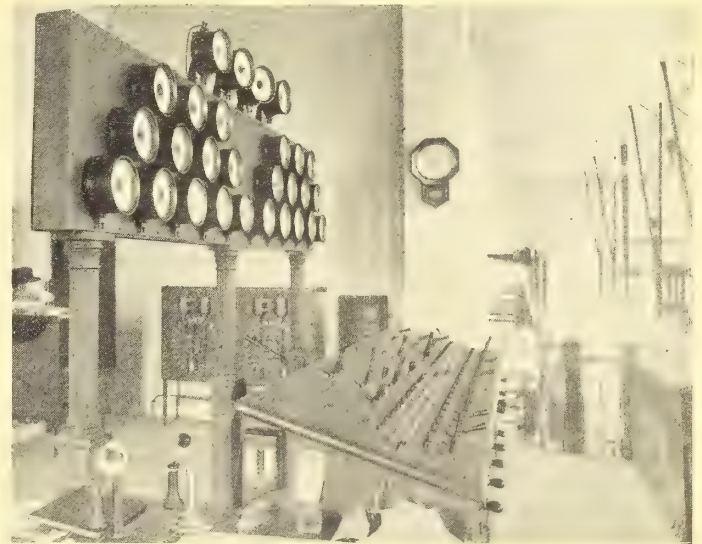
The contract for the construction of the plant was awarded to C. C. Moore & Company, of Seattle and San Francisco. This company has previously installed for the B. C. E. R. Co. the steam auxiliary at Vancouver, where a plant of 20,000 horse power is now in operation.

The new steam auxiliary with its output of 6,000 horse power, will raise the company's total output on Vancouver Island to 22,500 horse power. One unit of 6,000 horse power is now in operation at the Jordan River hydro-electric plant, particulars of which appeared in our issue of last September, and another unit of 6,000 horse power is now being installed at this point. At Goldstream the company has a hydro-electric plant capable of an output of 3,000 horse power, and in Victoria a steam auxiliary plant where 1,500 horse power is available for service. In addition to the above, the future needs of Victoria and vicinity have been well provided for as the revised plans for the development of the Jordan River plant call for an output of 36,000 horse power.

The contract for the Saanich Inlet steam auxiliary calls for its completion at the earliest possible moment, and the contractors are already actively at work on the project. It is hoped to have it ready for service during the coming fall, when it is expected that at least a portion of the Saanich interurban line will be open for traffic, and that manufacturing operations will by that time have been started at the large cement plant now being constructed out on the route.

Sub-Station No. 1 of the City Light and Power Department, Winnipeg—Photos Show Terminal Station Equipment

Since the general description of the city of Winnipeg's new power undertaking appeared in the December issue of the Electrical News, there has been completed the principal distributing system and offices on King street in the heart of the city, and work has started on several other stations, brief descriptions of which have appeared from time to time. A more detailed description of the King Street station is given herein, and also photographs of the station equipment



Control bench board—City terminal station

at the Terminal Station, a detailed description of which appeared in the issue above referred to.

The King Street station or sub-station No. 1 is located on King street within a stone's throw of the business centre of the city, and is the principal distributing station for all of the underground, and a large part of the residential district. At present both underground and overhead lines leave

the building, the latter being only temporary, however. Power is delivered to this station through a duplicate set of 13,000 volt cables from the terminal station on Point Douglas. Westinghouse type C, automatic, oil circuit-breakers are installed on each incoming line, and a tie switch is provided on the station side of the circuit breakers. From the circuit breakers the 13,000 volt leads go directly to the transformers, of which there are at present two banks each comprising three 500 kw. Crocker Wheeler self-cooled, oil-insulated, 13000/2200 volt transformers. On the secondary side of each is a non-automatic oil switch operated from the transformer panel in front of each bank. The 13,000

supervision of Smith, Kerry & Chace. Mr. J. G. Glasco is at present acting manager of the department.

The Stadacona Hydraulic Company—Construction Under Way at Seven Falls—20,000 h. p. Available

Work is now in progress on the hydro-electric scheme of the Stadacona Hydraulic Company, Limited, Quebec, which is undertaking the development of the power at Seven Falls, on the Ste. Anne River, Montmorency County, P.Q., where the river has a natural difference in elevation of about 360 feet in a distance of about 3,500 feet. This natural head will be increased to 420 feet by the erection of a reinforced concrete dam and bulkhead of the Ambursen type now under construction by the Ambursen Hydraulic Construction Company of Canada, Montreal, who are also contractors for the power house building and excavation necessary in tail-race and on penstock route. It is proposed to obtain an initial development of 10,000 horse power, which will be disposed of to large consumers only.

The Ste. Anne river takes its rise in the Laurentian National Park, Charlevoix County, Quebec, and flowing in a southeasterly direction empties into the St. Lawrence about



13,000 V. concrete switch structure—Terminal station

volt oil circuit breakers are mounted on a concrete structure on the main floor, while all the 2200 volt oil switches and circuit breakers are mounted in the basement. As there is considerable demand in the down town district for direct current power for many uses, two synchronous motor-generator sets are installed for these services. These have 2200 volt synchronous motors driving a 500 kw. 250/500 volt, three wire direct current generator manufactured by the Siemens company in England. There are a number of three phase feeders for power uses and single phase feeders through automatic induction regulators for lighting distribution. The generators are somewhat different to those generally seen in this country in that the commutator is divided in two separate parts with a ventilating duct between the two sections and the connecting strips between the commutators serve as fans to draw the air through the commutator spider. This should ensure a cool running commutator. Rather a special feature about these sets is the manner in which they are started. A small induction motor generator set is provided with a d.c. generator of sufficient capacity to provide current for the motor-generator excitors which are used as starting motors. After they have been synchronized the field is put on the exciter by means of field transfer switches, which do not break the circuit. The motor-generator set which is used for starting purposes is also used for charging a small storage battery for control and other auxiliary equipment.

For the control of this equipment there is a 21 panel Blue Vermont switchboard, of which there are five 3-phase feeder panels, six single phase, three synchronous motor panels, two generator panels, four d.c. feeder panels, and one 13000 volt line panel, as well as the transformer panels. All the switching equipment was furnished and erected by the Canadian Westinghouse Company.

This equipment is housed in the same building which also contains the offices of the City Light and Power Department. This station was designed and built under the



Seven Falls, Ste Anne River—20,000 h. p. available

27 miles below the city of Quebec. The drainage area tributary to the Seven Falls is about 350 square miles. The length of the main river is about 60 miles, with an average width of 100 to 150 feet. Its headwaters are supplied from numerous lakes, fed from springs and naturally filtered underground sources. The northern latitude in which these headwaters are situated and the mountainous and well-wooded character of the country maintain a run-off from

melting snow well into the summer months. The fact that the Provincial Government has under preservation the greater part of this drainage area as a national park insures the conservation of the forests. The land is only partly under cultivation for a distance of about five miles above the site. Flowing through a mountainous country the natural slope is fairly great, the bed being mostly rock and boulder stone, the water being remarkably clear and free from sand or debris. Many of the lakes tributary to the river are of considerable area, with narrow outlets, presenting excellent opportunity for storage reservoirs when these are required. About nine miles from its mouth, the river falls over a series of precipices forming what are called the Seven Falls, having a total height of 363 feet in a distance of about 3,500 feet. The parish of St. Tite is situated on one side and that of St. Fereol on the other. The banks are high and abrupt, increasing from about 80 feet at the head of the seventh fall to 500 feet at the foot of the first fall. The geological formation is a typical Laurentian gneiss composed of quartz, feldspar, and small quantities of iron pyrites. At the head of the seventh fall the river has changed its course, the present bed being separated from the old channel by an island about half a mile in length, thickly wooded, with precipitous banks on both sides. The utilization of the old channel for head works and tail race and the island for water conduit presents itself naturally as a feasible and practicable means of development.

A water conduit approximately 3,000 feet in length, comprising steel flow pipe and pressure penstock eight feet in diameter now under construction by Walsh's Steam Boiler Works will have a capacity sufficient for supplying four 5,000 horse power turbines under a working head of 410 feet, one of which will be a spare unit and two of which will be installed at present. There will also be two exciter turbines of 200 horse power each. The main turbines and the two exciter turbines will be supplied by the Voith Engineering Works, Heidenheim, Germany. The penstock will be buried in the earth for the greater part of its length. The thickness of the turbine will vary from $\frac{3}{8}$ in. to $\frac{7}{8}$ in., there being approximately 800 tons of steel required. The power house will have an ultimate installation of four high head



Penstock intake bench—Seven Falls, Ste Anne River

turbines of the power above mentioned, direct coupled to four 2750 kw. generators operating at 630 revolutions per minute and at a voltage of 6600, which will be raised to 44,000 volts by step-up transformers in four banks, each bank of three transformers with one generator and turbine being considered as a unit for delivering 5,000 horse power to the transmission system.

The generating stations will be fireproof throughout, having rubble concrete foundations and superstructure of reinforced concrete. A transmission line is now under construction for delivery of power at Ste. Anne, a distance of twelve miles from the generating station, where connection is made with the lines of the Quebec Railway, Light, Heat & Power Company. This transmission line will also deliver power to the Bayless Pulp & Paper Company for the operation of a pulp mill. The Quebec R., L., H. & P. Co. propose to sell the power to the city and surrounding district, and under this arrangement the Stadacona company will be relieved of the cost of erecting poles and wires for supply-



Cut-off trench excavation—Stadacona Hydraulic Co.

ing small consumers. The development has been carefully studied with a view to taking advantage of the head available in conjunction with the storage to be derived from the watershed, and with the modern and efficient equipment proposed will develop power on the turbine shaft at a capital cost which will, it is claimed, compare favorably with other hydro-electric developments in America.

The company is backed by a group of Montreal, Quebec and foreign capitalists. Among the interests identified with the company are: President, Hon. L. P. Pelletier, Postmaster-general of Canada; Sir Rodolphe Forget, M.P.; Neuville Belleau, banker, Quebec; Hon. C. E. Dubord, Quebec, member of the Legislative Council of the Province of Quebec; D. O. Lesperance, banker, Quebec; Alfred Bouvier, Brussels; H. J. Bierman, Shawinigan Falls, and Andre de la Morinerie, France.

The engineers for the scheme are Messrs. R. S. Kelsch and A. R. Henry, of Montreal, and Mr. D. S. Barton, of Quebec.

The Canada Sales Co.

The Canada Sales Company have been in business since the first of the year and already report very satisfactory success in securing a fair share of Western trade. This company is handling electrical specialties, packing-house supplies, paper, twines and builders' materials. Having agents established in several of the best towns in Western Canada they are able to keep in very close touch with the extensive building of those progressive centres. They undertake the representation of factories only and do not intend to carry stock. They are open to receive correspondence from concerns wishing aggressive and keen representatives in Western Canada.

The head office of the Mexican Northern Power Company is to be moved to Toronto, from Montreal.

The Makers of Electrical Canada—13

A. A. DION—ENGINEER-SUPERINTENDENT

At a time when the valuable work of the Canadian Electrical Association has been so abundantly evidenced as has been the case during the recent Ottawa convention it is fitting that the name of the one man who, more than any other attending delegate, has labored ceaselessly and unselfishly to place the association in the useful position it occupies to-day, should receive more than passing mention—Mr. A. A. Dion, superintendent of the Ottawa Electric Company, four times president of the Canadian Electrical Association and a member of the executive committee continuously for the past fifteen years.

A trinity of outstanding characteristics have been the means of placing Mr. Dion in the enviable position he occupies to-day among Canadian electrical men. These are, first, an executive technical ability of a high order; second, a willing capacity for very hard work, and last, a strong desire to render real assistance to every cause with which he becomes associated. It is chiefly to the first of these characteristics, no doubt, that this company owes its splendid financial success, to which must be added that most valuable asset—satisfied customers—which Mr. Dion's straightforward methods, tactfulness in dealing with the public and ability to secure the loyal support of his employees, has always been able to secure for the Ottawa Electric Company.

And speaking of loyal support, it is indeed a pleasure to note the willing co-operation between employer and employee in Mr. Dion's company. We have already spoken in these pages of the company's kindly consideration of their employees in placing at their disposal an ample and well-furnished club-room for both social and intellectual entertainment, and the reciprocal side of the story was told during the recent convention when the Ottawa branch of the C. E. A., composed chiefly of Mr. Dion's co-workers in the Ottawa Electric Company, presented him with a substantial token of their appreciation in the form of an illuminated address and a case of silver. With such a spirit pervading the day's work it is little wonder the operations of the company meet with success. Added to this, also, it must be noted that Mr. Dion was one of the first to recognize that in the operation of a public service system the customers' point of view must be considered as carefully as the company's. He early recognized that it was his duty to sell the people what they wanted rather than force them to take what he may happen to have for sale.

and in the recognition of this basic fact and in his missionary work in preaching the gospel of "good service" he has rendered incalculable assistance to the cause of privately owned public service corporations all over Canada.

And not only has Mr. Dion had charge, as superintendent, of his system, but he has also been the technical engineer on whose shoulders the responsibility of planning and constructing the generating and distribution plants has fallen. It is doubtless sufficient to state that his ability as an engineer is evidenced by his success as a superintendent, for what manager, however competent, could obtain the results shown here with an inefficient or badly constructed

operating system. Whether technical or commercial Mr. Dion's work has meant honor to himself, profit to his company, and an example worthy to be followed by his electrical co-workers throughout the Dominion.

We have become so accustomed to associating the names Dion and Ottawa that it comes almost as a surprise to most of us to remember that it was not always so. Mr. Dion was formerly connected with the old Dominion Telegraph Company and later held the position of electrician on the Intercolonial Railway of Canada, before coming to Ottawa as superintendent of the Chaudiere Electric Light & Power Co. Afterwards this company was merged with the Standard Electric Company and the Ottawa Electric Company came into existence. Thanks to its able superintendent the history of this company, in spite of much adversity, has been one of continued success so that it stands in the very front rank with the public service corporations of to-day who make "efficient service" their daily motto.



Mr. A. A. Dion

vice corporations of to-day who make "efficient service" their daily motto.

A telephone office at Sydney, near Victoria, is to be opened in the near future. A lot was recently purchased on which the company intends to build. The new Collingwood exchange will be ready for use on September 15. On June 15 the company took over the new office at Kamloops; this is a \$12,000 structure, and was built to accommodate a capacity of 2,500 subscribers. The new switchboard at Eburne, near Vancouver, has been installed, and is in good working order. The company is also putting considerable underground work in the east end of Vancouver. Conduits are being laid on Keefer and Harris streets from Victoria Drive to Heatley avenue. Other conduits are being placed on Victoria Drive from Powell street to sixth avenue.

The Progress of Street Illumination

By H. D. G. Crerar

It was in 1813, nearly 100 years ago, in the streets of Westminster in London, that a commercial system of street lighting was first installed. The illuminant was artificial gas, with a burner of the bats wing type. As to the spacing and height of the resultant illumination we have no data. This installation aroused a great deal of interest and was quickly followed by the introduction of street lighting by this method in the principal towns of the United Kingdom. Further improvements during the succeeding years came slowly but steadily. Luminosity is an effect of incandescence, the light from a gas flame being the result, largely, of the heat of the flame acting on the carbon particles in the gas. Elevation of the temperature of the flame gives a proportionate increase in the resultant luminosity, but the speedy destruction of the burner by very high temperatures imposes a commercial restriction on a practical utilization of this fact. Investigation and experiments to increase the temperature of the flame without greater consumption of gas, and the augmentation of the incandescence without a destructive rise of temperature, in course of time resulted in the successful adaptation, to a gas flame, of the principle of the Argand oil lamp burner, with a cylindrical flame and interior air admixture. Later the Welsbach and other mantles were introduced, bringing gas lighting to its present satisfactory lighting stage where a given quantity of gas yields about 30 times the illumination obtained from it in the original installation in the streets of London when George III was King.

Until the Welsbach mantle arrived, gas was subject to too many disadvantages to be a satisfactory street illuminant. The intensity of the light sources was low, necessitating close spacing and excessive cost of installation and the lamps needed frequent attention involving high cost of up-keep. Meanwhile, about 1877, the Electric Arc lamp, which had been known as a laboratory possibility from a date prior to the beginning of street gas lighting, began to make its appearance as a street illuminant, and soon became recognized as a probable successful rival of the gas lamp. Here was a light source with a maximum of approximately 2000 candle power in the standard 500 watt type. This meant wide spacing and relatively low installation cost, and lighting by electric arc came into immediate favor. By 1880 several installations had been put in, but, as had been the case with gas lighting, progress was very gradual. The cost of maintenance per lamp was high and the violet colored lighting and the sharp shadows were disadvantageous though not serious enough to outweigh the manifest superiority of electric lighting over gas lighting until the vast improvement in the latter by the perfecting of the incandescent mantle, when gas lighting again returned to favor, and became, as it is to-day, a considerable competitor with the arc light even where the cost of current is relatively low.

Within the last two years metallic filament incandescent lamps have made their appearance, and introduced a new and important factor to be considered in arriving at a conclusion as to the most desirable method of street lighting.

This brief resume of the subject matter of this paper brings us to modern times when the possibilities of the latest improvements in incandescent electric lamps, added to the illuminating facilities previously afforded, and the enormous increase in the available commercial supply of electric current, have presented, and will continue to present, so many problems of efficiency, economy and aesthetics in street illumination, that illuminating engineering has at

length become recognized as an important branch of Applied Science.

No department of knowledge can be considered a science until the results of many investigations within that department have been worked out and systematized. With no better measuring apparatus than the human eye, no more accurate records by which to make comparisons than the memory of optical impressions, and no more exact terminology than adjectives ranging from "very fair" to "excellent," scientific data for the studying of street lighting were not ascertainable, and the adoption of any scheme of out-door illumination was necessarily based, to a certain extent, on conjectural data that subsequent test might or might not justify.

From the experiments and investigations of Sir W. H. Preece, in 1883, came the portable illumination photometer with the aid of which it became possible to ascertain closely the comparative illuminating values of different sources of light, and to measure the factors which determine the efficiency of any particular system of lighting. This placed illumination on an engineering basis.

Credit for the great strides in the study of illumination made in the last ten years is due in a large measure to the manufacturers of lighting equipment who realized that it was necessary, in order to create a demand for their apparatus, to teach the public what artificial illumination really might be and how it could be best obtained.

Ultimate Efficiency

In measuring the ultimate efficiency of a system of illumination there are other facts to consider than the comparison between energy in-put and energy out-put. There is the problem of the economical and effectual transformation of electrical energy into light energy, and the problem of distribution with the minimum loss of this flux of light over the desired area. There is also the question of optical efficiency or the distribution of this flux of light in such a manner and in such directions and intensities as will permit the highest acuity of vision obtainable with the permissible minimum illumination, having regard to the locality to be lighted. Lastly there has to be considered the decorative effect of the installation by day as well as night. The comparative efficiency of a light source is determined by the comparison of watts in-put to mean spherical candle-power produced in the lamp, taken into account with the cost of lamp up-keep and renewals, the whole result being expressed in cost per candle hour. From any source of light the flux of light would, unless obstructed or deflected by exterior obstacles, radiate more or less evenly in all directions. If the light produced spends itself in all directions, there is so much less to go in any one direction. When lights are suspended over city streets, the object is to illuminate the roadway and the space a few feet above, and all light which does not ultimately help in the illumination of this area is wasted. Therefore, as far as possible all flux of light originally flowing into waste space, so to speak, should be re-directed to where it will be of some use. The efficiency of this re-direction is ascertainable by comparing the flux received on the horizontal area which the lamp is intended to illuminate, with the total flux generated in the lamp, and this depends largely on the efficiency of the reflecting apparatus.

The chief optical inefficiency in a street lighting system, and one extremely difficult to avoid, is glare. Light sources, no matter how well diffused, should not be so placed as to intrude within the line of vision, for in such a case the re-

sulting strain on the eye from the direct glare has the effect of a considerable lowering of the efficiency of the lighting system. Generally speaking light entering the eye at an angle with the vertical greater than approximately 25 degrees produces the effect of glare, and in laying out a system this should be borne in mind. Another inefficiency is unevenness in the illumination of the area intended to be lighted. An exaggerated example of this effect is that experienced immediately after entering a house from the sunny street. The eyes are for a time unable to distinguish the surroundings, although the interior illumination may be ample, for the reason that the focusing of the eye is not an instantaneous operation. When walking along a street subject to rapid changes of illumination, the resultant lag in the focusing of the eye lowers the apparent average illumination. In residential districts, however, where the minimum illumination permissible is desired, it is, probably better to aim at a moderate diversity rather than an absolute evenness of illumination, for, a total lack of shadow and the absence of the "silhouette" effect, make objects difficult of perception in low intensities of illumination.

The system of street lighting by arc lamps, though an improvement on the gas burner, was still far from the ideal striven for by the illuminating engineer. The high candle power intensity of the light sources necessitated considerable height as well as wide spacing in order to obtain an even illumination. This is not practicable in many residential districts where, by reason of trees lining the streets, lamps had to be hung not more than 25 or 30 feet from the ground. To give by means of arc lamps the necessary high average of even illumination on a shaded street meant the close spacing of low hung lamps and an excessive cost both of installation and maintenance. Such illumination as can be procured at reasonable expense involves wide spaces between the lamps, and comparatively close proximity of the lamps to the ground. This arrangement gives glare and needlessly high lighting directly under the lamp. The shadows from objects between the observer and the lamp are so exaggerated as to make it difficult, if not impossible, to distinguish shadow from substance, and the region immediately beyond the lamp is, to the observer, in nearly absolute darkness. Moreover, the quality of the light left a great deal to be desired, and flickering was also a disagreeable feature.

These disadvantages were all realized by the illuminating engineer, and the arrival of the metal filament lamp improved the possibilities of street lighting considerably. The efficiency of this type of lamp was comparative to that of the arc itself, and the wide range of obtainable candle power intensities made it specially suitable for the varying conditions under which a street lighting system has to be laid out. The appearance of this lamp on the market started what might be called a boom in street illumination. The commercial value of well and artistically lighted streets to a municipality is obvious, and installations of a modern ornamental system of city street lighting began to become general.

The Five-light Standard

One of the most favored designs for down-town lighting is a five-lamp standard of the type used in Toronto, Hamilton and other Canadian cities. The total candle power of the cluster varies from 300 to 400 candle power, and the distance between 75 and 100 feet. The lamps are enclosed in opalescent globes in order to properly diffuse the light from these low hung illuminants of high intrinsic brilliancy, giving an additional attractiveness to the installation, though at the cost of an absorption of twenty per cent. or more of the total light generated. The result in street illumination is an undoubted improvement over that obtained from arc lamp installations. The average illumination is of an even-

ness hitherto unattained, and the general effect both by night and day is artistic and pleasing. Installations of this type are apparently still meeting with favor.

In conclusion, it might not be out of place to discuss this type of street lighting system on the basis of the principles given earlier in this paper and consider if and where-in possible improvements might be made. The first point which must strike every illuminating engineer is the inherent inefficiency in a light source consisting of a number of small units in the form of a cluster doing the work of a single unit of practical size. The light distribution of an individual incandescent lamp enclosed in a pendant or upright globe is at best unsatisfactory and wasteful for street lighting; add to this the interference of one lamp with the light rays of another, which is a feature of a cluster, and the total obstruction of the light in certain directions by parts of the standard itself, and we have a piece of lighting apparatus which cannot be called ideal. An obvious way out of most of these inefficiencies is the employment of a single lamp which would produce the same illumination from an appreciably smaller candle power intensity than that of the cluster, which would have the additional advantages of a longer life at a slightly higher efficiency, and a considerable saving in the first cost of the installation. This may be thought to lack, to some extent, the artistic effect of the cluster, but improved designs will probably meet this objection.

Trend Towards Single Units

Another inefficiency noticeable in any system of ornamental street lighting, using lamps surrounded by diffusing globes only, is the failure to re-direct the available flux of light over the desired area. This unutilized flux is more than half the generated light energy, and this great loss could be cut down considerably by suitable reflecting apparatus without serious impairment to the artistic effect.

With this type of street lighting there is found again, although much modified owing to good diffusion, a certain amount of glare. From these comparatively low light sources the light entering the eye is of a considerably higher intensity than that which reaches the ground, the discrepancy producing the usual effect of lowering the apparent illumination of the street, and at the same time being harmful to the eyes.

It is therefore submitted, with some confidence, for the consideration of illuminating engineers and others interested, that this illumination of our streets can be improved at a lessened expense by increasing the height of the lamp standards, the adoption of reflectors limiting the flux of light from each standard to the area apportioned to such standard, and the substitution of single lamps of sufficient power for the clusters now in fashion.

Canadian Collieries

Developments approximating in actual expenditure something approaching two million dollars are at present under way by the Canadian Collieries, Limited, in connection with their properties on Vancouver Island. The developments referred to, comprise the building of a new railway line from Trent River to the new No. 8 shaft, the rebuilding of a portion of the line with eighty-pound steel, and the construction of a hydro-electric plant to supplement the present steam power. It is estimated that the construction of the new line alone will cost in the neighborhood of \$850,000, while the cost of the hydro-electric plant, upon which construction has already commenced, will cost \$70,000. It is stated that the opening up of the new shaft will mean the employment of 750 additional men. This means great development in the Comox district.



ROBERT F. PACK,
President-Elect Canadian Electrical Association.

The Twenty-second C. E. A. Convention

Most Enthusiastic Gathering in the History of the Association —Papers of Unusual Interest—Ottawa a Most Hospitable City

The Canadian Electrical Association held its Twenty-second Annual Convention at the Chateau Laurier, in the city of Ottawa, on Wednesday, Thursday and Friday, June 19th, 20th, and 21st, 1912. The magnificence of the new hotel which has just been completed, with its beautiful surroundings, combined with the city of Ottawa being the Capital city of Canada, with its many features of interest, made it one of the most enjoyable meetings ever held by the association.

At ten o'clock on Wednesday morning, June 19th, the session opened. Acting Mayor Hinchey welcomed the members of the association to the city and in his address expressed the great pleasure he had in meeting so many prominent electrical men. The city, he said, was growing very rapidly, and so many improvements were going on that he feared the members would not have such a favorable impression of the capital as they otherwise would. He referred to the visit of their Royal Highnesses, the Duke and Duchess of Cornwall and York, now the King and Queen of England, stating that on that occasion the school children of the separate and public schools had joined together in singing songs to welcome the royal visitors, and he was glad to say that all was peace and harmony in the city of Ottawa. In conclusion he expressed the hope that great advantage would accrue to the association by reason of the conferences which would be held.

The President, Mr. A. A. Dion, replying to the address of welcome, said that the city of Ottawa was progressing very rapidly and that the electrical people were contributing their full share. The President, in his annual address, welcomed the association and said he was glad that the privilege had been given him to preside over a meeting at his home city before retiring from office. He was glad, he said, that there had been a healthy increase in the membership during the last year although the efforts put forth had not resulted in all that had been expected, as he thought too many companies were outside the field. However, there was reason for congratulation in the growth of the company sections, of which there were five, in the following cities:—Toronto, Montreal, Ottawa, Hamilton, and Vancouver. In conclusion he thanked the members for electing him so many times on the managing committee, but it was now time for him to retire and make room for others, with new plans and new ideas for the greater effectiveness of the association.

The secretary-treasurer, Mr. T. S. Young, then presented his annual report, reviewing the work of the past year, which showed the membership on May 31st, 1912, to be 586, made up as follows:—Class "A" 48; Class "B" 448; Class "C" 27; Class "D" 9; Class "E" 54. In concluding his report Mr. Young tendered his resignation as secretary-treasurer and expressed his appreciation of the courtesy and consideration shown him at all times by the officers and members. Mr. R. F. Pack moved the adoption of the report, and expressed his deep regret at the secretary-treasurer's resignation, which, he felt, would be a serious loss to the association. Mr. A. L. Mudge, in seconding the motion, suggested that a standing vote should be taken. Mr. Frederic Nicholls said he thought the expression of regret should take some more tangible form, at least an illuminated address expressing appreciation for his past services. This suggestion was unanimously adopted. Mr. Young expressed his regret at being obliged to relinquish his duties as secretary-treasurer

after having been connected with the association so long, but felt it was unavoidable. While relinquishing the active work he would still be glad to promote the interests of the association in every possible way.

As Mr. Nicholls could only spend the first day at the convention, owing to business engagements, he was called upon to address the meeting. Mr. Nicholls replied that he did not feel that he should make a lengthy address at this time, but said he regretted exceedingly being called away as he had always enjoyed meeting the members at the association meetings and had looked forward to a pleasant time at this convention.

Mr. D. H. McDougall was not present to give a report of the Membership Committee but the Secretary's report showed what had been done in that regard.

Report of Meter Committee

Mr. L. V. Webber then read the report of the Meter Committee in which he outlined the advancement in the production of meters which were now being placed on the Canadian market. He said that there appeared to be an extensive field for demand meters and indicators, and a combined integrating and demand meter was now being put on the market which might prove useful. He thought the maximum demand meter was of great importance in connection with the sale of large blocks of power, especially where polyphase current at high potential was used, as those contracts were usually made on the demand basis. He referred to certain types of meters which were now on the market, and recommended the purchase by the central stations of "The Meter Man's Handbook," prepared by the Committee.

The adoption of the report was moved by Mr. A. L. Mudge, who drew the attention of the members to the fact that a very comprehensive report had been submitted last year by the meter committee, and that this report was merely a continuation of that report. He thought that the adoption of the integrating watt-meter with a maximum demand attachment would come more into use when it became cheaper. Mr. Pratt, of Hamilton, seconded the adoption of the report, expressing his appreciation of the very useful work which had been done by Mr. Webber for the last four or five years. Mr. R. F. Pack, in following up the discussion on the report said he was inclined to think that the general trend was towards the use of maximum demand meters for comparatively small installations, and if that was so it would be absolutely necessary for the manufacturers to turn out a meter that would be fairly accurate and efficient at an extremely low cost, for if it was necessary to instal an expensive type of meter to measure the current consumption as well as the maximum demand it would mean the companies would be very severely penalized. Mr. Lambe, of Ottawa, stated that the buyer had it in his own hands, because if he demanded great accuracy the cost would have to go up and stay up, but if he was satisfied with a meter that would fulfil less hard conditions then the manufacturer could bring out a meter at a much lower price.

At this point the President read a communication from Mr. F. A. Cote, of Sorel, Quebec, referring to the load controller, stating that he had perfected an instrument that was reliable and cheap and of very simple construction.

In answer to a question by the President as to the construction of this attachment Mr. Webber stated there were a number of companies which were making integrating me-

ters with demand attachments which would give an integrating reading and at the same time a hand was moved around to the demand and held there until it was set back, and that the time lag was adjustable. He thought the meters cost something like \$50 for perhaps 80 amperes, and if they could produce a 25 ampere meter for \$10 or \$15 less it would meet the demand. Mr. McLachlan asked if the limit set by the government would allow for any reasonable depletion in the price, to which Mr. Lambe replied that the government limits were very wide and he thought the consumers' demands regulated the price. Mr. Morrow asked if there were slot meters on the market in general use, and the President in reply said that his company were using some electric slot meters, part of United States make and others of European make, which were giving fair satisfaction and were of considerable assistance in keeping customers on the books who might otherwise not be on. The motion to adopt the report was put and declared carried.

Mr. T. F. Kelly read the report of the Commercial Committee outlining the work which had been done during the past year. An extract of this report follows:—

Report of the Commercial Committee

This committee was composed of Messrs. T. F. Kelly, (chairman), P. H. Kemble, W. L. Adams, R. B. Snider, and W. H. McIntyre. A number of questions had been sent out to the 45 company members of the association. Answers were received and tabulated from 32 of these. The questions asked and the replies received were briefly as follows:—

Have you electric competition?—6, private; 4, municipal; 2, both municipal and private.

Have you gas competition?—16, yes; 6, with artificial gas; 2, with natural gas; 1 with both; 7, own the gas business, thus eliminating destructive competition.

Separate department to secure new business?—10 main tain separate departments.

How many persons in this department?—18 companies have one or more.

Paid by salary or commission?—14 companies pay salary; 4 pay both salary and commission.

Have you display rooms?—20 companies, yes.

What appliances sent out on trial?—20 send out appliances of various kinds, of which apparatus, irons are the most prominent.

Do you work on installment plan?—19 companies accept payment in this way.

Do you advertise?—23 companies do.

Are carbon lamps supplied free?—7 companies supply the first carbon lamps free to their commercial lighting customers, 11 renew commercial carbon lamps, 8 companies supply first carbon lamps in domestic lighting, 13 renew them. 6 companies deliver these lamps to the customers.

Do you do inside wiring?—16 companies answered in the affirmative, most of them receiving payment in installments. Two companies do wiring through electrical contractors, paying the contractor immediately but accepting payment from the customers in installments.

Do you sell fixtures?—17 companies answered yes, and 12 accept payment on the installment plan.

Do you sell motors?—19 companies do and 15 accept payment in installments.

Do you rent tungsten lamps?—4 companies follow this plan. They report that this has been found an excellent business getter and retainer especially where there is other electrical or artificial gas competition.

A number of replies were received from some of the more vigorous companies as to their methods of getting new business. One told of wiring houses on the installment plan; another of their systematic mapping out of the town so as to be intimately in touch with the conditions in

every home. A third spoke of advertising in moving picture shows. A fourth makes use of the electrical contractor. A fifth considered a satisfactory service at all times the best means of getting business, and so on. A western company spoke of the large amount of business they had been able to obtain in sawmills. Notwithstanding the arguments advanced by sawmill owners that electricity cannot compete with steam for the reason that fuel at a sawmill costs nothing, they have been able to demonstrate successfully in a number of cases that this argument is wrong. Extensive tests have been made occupying the attention of an engineer and assistant over several weeks which has often resulted in placing a single trial motor to demonstrate the advantages to the mill owners. This company reports that in this way they have just succeeded in replacing some 1,500 h.p. steam drive by motors in one of the largest sawmills in British Columbia.

The paper called forth an interesting discussion on the question of the wiring of houses by the companies, and supplying lamps, which was discussed by Mr. R. B. McDunnough, Mr. P. H. Kemble, Mr. J. G. Henninger, of Cleveland, Mr. Larmouth, Mr. McDougall, and Mr. McLachlan. The consensus of opinion seemed to be that it was wise for the companies to supply the lamps and thus have some control over the lighting. Mr. Pratt asked if the companies furnishing tungsten lamps on a rental and maintenance proposition had any trouble with the customers removing the lamps and using them in other places, or if any of the companies had used the lock socket to prevent this, to which Mr. Larmouth replied that they had tried that system in Peterborough and found that the lock socket appliance was not very satisfactory as it was easy to turn the lock with a piece of metal.

After the reading of communications by the secretary the meeting adjourned till 2 o'clock p.m.

Afternoon Session (June 19th)

At two o'clock p.m. the President called the meeting to order and asked Professor H. T. Barnes, D.Sc., F.R.S., of McGill University, Montreal, to give his paper on "The Influence of Ice on Water Power Development."

THE INFLUENCE OF ICE ON WATER POWER DEVELOPMENT

By H. T. Barnes, D.Sc., F.R.S.

Professor Barnes in a short paper outlined the troubles that are apt to occur due to ice formation in power plants of different designs. It is first pointed out in an elementary way how water maintains practically a constant temperature while freezing and similarly ice maintains practically a constant temperature while melting, the temperature being found to be of the order of a hundredth of a degree from the freezing temperature in either case. The three distinct forms of ice met with in nature, namely, surface ice, frazil ice and anchor or ground ice, are discussed briefly:

Surface ice.—Whenever water is still ice forms rapidly over the surface. A sheet of ice may be formed commencing from the shore and working outward but more often from the freezing of the frazil and scum ice blown by the cold wind into the bays or inlets. In this case the ice grows backward against the wind. The first method of freezing requires absolutely quiet conditions but the second will often proceed in the presence of quite a rapid current. In both cases the water must be at the freezing point. The rate of freezing is increased greatly by a dry north wind as this produces more rapid evaporation which in turn absorbs more heat. As soon as a first ice layer is formed the thickness of the sheet grows more rapidly by heat conduction through the ice. There is a limiting thickness however, determined by the temperature of the water under the

ice. In our rivers the water is seldom quite as cold as the freezing point and the average water temperature under the ice has been shown to be a fraction of a degree above freezing. This is also shown by the fact that water currents directed against the surface of the ice will produce what are known as air-holes.

Surface ice when it can be induced to grow, is a protection to the water and prevents scum and frazil ice but it also keeps the water temperature low in the spring by reflecting the sun's rays. Water running under surface ice faster than half a mile an hour will carry floating ice with it and attention is directed to this whenever an intake is stationed in open water.

Frazil ice.—This, as its name implies, is cinder ice, so called from its resemblance to cinders or ashes. It is the fine needle ice found floating in the open water and varies in size from minute crystals up. It is formed by surface cooling in water flowing too swiftly for surface ice to form. An estimate of the number of these small crystals in a cubic foot of water on an average cold day shows about a quarter of a million but the paper states that several millions have often been found. The current carries these crystals downwards and under the surface ice which extends over the quieter parts of the water and there they settle upwards and become attached to the under side of the surface sheet, in a short time producing immense hanging dams which impede the water course and cause a rise of water level. During cold winter nights the water and objects in it become super-cooled so that ice forms rapidly and sometimes covers the entire river bottom. This kind of ice does not play an important part in power house troubles as, during the period of frazil formation, the anchor ice is held to the bottom.

Anchor ice.—In an open river, in winter, ice forms on the surface of objects immersed. This is called anchor ice which forms primarily from the cooling of the river by radiation, water being an almost perfect radiator. During cold winter nights the water and objects in it become super-cooled so that ice forms rapidly and sometimes covers the entire river bottom. This kind of ice does not play an important part in power house troubles as, during the period of frazil formation, the anchor ice is held to the bottom.

Where a power house is located on a body of water which freezes over for many miles above, usually no trouble from ice need be feared when the water is once frozen over. If the forebay is fed from open water however, frazil jams are sure to occur and in this case it is better to run a canal up to the position of permanent surface ice. When jams occur due to the formation of frazil ice little can be done beyond blowing up the ice by dynamite and blasting out a clear channel in which case the frazil has to be removed as it comes down with the current. When a forebay is fed from open water it is better to keep it from freezing and handle the ice at the power house.

The paper speaks of special heating devices which are now used to avoid the sticking and freezing of the frazil crystals. Racks must be protected by a curtain wall from the cold air currents and may, under certain circumstances, require direct heating. Revolving racks are suggested under these circumstances and steam heating appliances.

The following simple rules are appended for avoiding ice troubles:

- (1) Have covered racks and steam-heat provided for the trouble which always comes to a power house before the permanent ice forms.
- (2) Instal a few meteorological instruments to watch the weather in order to be prepared for the first cold snap.
- (3) Where the forebay is fed from a lake or canal, induce freezing as soon as possible; otherwise maintain an

open channel down to the power house. Provide a special way for the floating frazil.

(4) Watch the temperature of the winter at the outset of cold weather, and when 32 degrees F. is approached, have the steam-heating plant in readiness.

Discussion

Before reading the paper Dr. Barnes expressed his appreciation of the invitation he had received to read a paper before the Canadian Electrical Association, and said that he had been studying ice for the past seventeen years and would be very glad if the information he could give would be of use to some of the managers of power plants.

Dr. Barnes had a number of lantern slides thrown on the canvas showing the effects on ice of the sun's rays, rain and wind. He showed a number of views which had been taken of ice formation in the River St. Lawrence, Lachine Canal, and other points, and explained the different workings of surface ice, anchor ice, and frazil ice. He also showed some scenes on the River Neva in Russia, where experiments had been under way for some time. Dr. Barnes then explained the workings of the thermometer which he had perfected in order to detect by the temperature of the water the proximity of ice in an open river or ocean.

Mr. John Murphy, of Ottawa, in opening the discussion on the paper, also had some slides showing some of his observations with respect to ice formation. He went on to say that for a great many years the concerns with which he was connected were put out of business during part of the year by frazil ice or anchor ice. He had studied the question for a considerable number of years in an attempt to find out the cause of the trouble and had gathered together a large number of records of the temperature of the water. The temperature had been taken for four months during the winter three times a day, and each time the record had been 32 deg. F. He had read an article by Dr. Barnes some years ago and had found mentioned there that the temperature varied around 32.001 and 31.999, but his observations had given a temperature of 32.

Mr. Murphy had a number of interesting scenes showing the formation of ice at Niagara Falls, and different points, and also some scenes showing how ice had formed on the fire engines at certain fires. Scenes were also shown illustrating the construction of ice racks at different power stations, and systems of steam heating. He said it was very hard even with the facts as now known to get people to believe that it was possible to prevent "shut-downs" from ice, but was glad so say that a great deal had been learned about the formation of ice, and he had no doubt that the discoveries of Dr. Barnes would be of great benefit to all those who had been troubled with ice in connection with their power plants.

The discussion was continued by Mr. W. L. Bird, Mr. W. H. Munro, Mr. R. B. McDunnough, Mr. P. H. Kemble, Mr. Pratt, Mr. J. J. O'Donnell, and Mr. G. G. Gale.

The President then asked Mr. J. G. Henninger to read his paper on "Recent Developments in Lamps and Reflectors."

RECENT DEVELOPMENTS IN LAMPS AND REFLECTORS

By J. G. Henninger.

Electric illumination is treated first from an historic point of view from the year 1858 when the first patent was granted in the United States for an incandescent lamp with a platinum filament, down to the present year when the wire-drawn tungsten lamp has practically displaced all other forms of illumination.

An interesting table gives the relative efficiency of incandescent lamps. Taking 100 per cent. as the total energy

of coal consumed, it is shown that the energy radiated as light from a mazda lamp is only .6 of 1 per cent.; from a tantalum lamp .4 of 1 per cent.; from a gem .3 of 1 per cent; and from a carbon .2 of 1 per cent. The accompanying diagram illustrates these figures graphically.

The writer deals especially with the tremendous advancement in the illumination of all kinds of factory buildings. This was natural as proper illumination not only renders it much less dangerous to the workmen who may be operating machinery, but the workman's efficiency is much increased. The lamps are now better placed, reflectors are installed according to scientific calculations and not only is the light evenly and properly distributed, but by the use of small low voltage units over-illumination, which is equally as troublesome as under-illumination, has been remedied. Figures are given to show what a small percentage the installation of a proper illumination system actually costs as compared with the cost of labor. The figures indicate that, allowing a workman an area of 100 square feet this can be well illuminated for 1.72c per day or the equivalent of only 2.9 minutes of the man's time. When this small cost is contrasted with the increased efficiency of the workman, the reduced liability of accidents, the increase in production and

took place. The hotel was prettily decorated with Japanese lanterns. Refreshments were served during the evening and the party again returned by special cars to Ottawa, having spent, as all agree, a most enjoyable evening.

Morning Session (June 20th)

On resuming, Thursday morning, June 20th, the discussion of Mr. Henninger's paper was taken up. Mr. McDunnough opened the discussion by complimenting Mr. Henninger on the very interesting paper he had read which was of value, particularly, to the managers of small central stations or in cities up to 20,000 population. In a city of that size the central station man was obliged to be very largely an illuminating engineer, and in that way he could exercise a great influence upon the users of light and could, by some little tact, induce the people to use proper fixtures, glassware and globes, and thus the customer would be satisfied. In some cases when the lamps burned out the customer did not go to the central station manager for them and oftentimes got a lamp of too small or too great power, and, not getting the results, became dissatisfied. The central station manager should try to educate the customers to apply to him for new lamps and he could then see that lamps of the right power were used.

Mr. T. F. Kelly followed, outlining what had been done in Hamilton in the way of lectures on illumination to which the merchants were invited. This was followed by sending men around to lay out lighting schemes, which was found to be a great help in satisfying the customers of the company. During the last year they had sent out invitations through the Board of Trade to the manufacturers and an excellent meeting had been the result. An illuminating engineer had given an address with the result that a number of the manufacturers took up the scheme of lighting their factories and mills in Hamilton. They had had some trouble in getting the merchants to put in proper fixtures and lamps in order to get the best results.

Mr. O. Higman, of Ottawa, asked the writer of the paper if he knew of any use being made of luminous tubes. Mr. Henninger knew of one company in the United States making tubes of varying lengths operated by high voltage discharge through a low pressure gas, which gave a light somewhat similar to daylight, and was used to quite an extent in color matching. There were some drawbacks to the scheme as yet, but long lighting tubes were considered more efficient than short ones. Mr. Henninger went on to say that his idea in writing this paper in the manner he did was to cover the subject in a general way and to point out the various things which were being considered, and then the members could think over it and come to a conclusion themselves. As a matter of fact there were difficulties in each system and perhaps one system would be the best for one place while a different method would be more suitable for another. It seemed to him that diffusion was the keynote of the situation and as an illustration described the system used in the draughting room of his company.

Mr. MacLachlan asked the writer if anything had been done to get rid of the ultra-violet in the light, as this question was sometimes brought up where there was opposition by a gas company. Mr. Henninger in replying said that he had never heard of anyone complaining about the ultra violet in the tungsten or carbon lamp. Mr. P. H. Kemble suggested that the difficulty might be overcome by dipping the lamp in a solution of potassium bichromate.

The next item was a paper on distribution work by Mr. S. Bingham Hood.

FIG 1

RELATIVE EFFICIENCY OF INCANDESCENT LAMPS.

		TOTAL ENERGY OF COAL	100.0%
		ENERGY SUPPLIED TO LAMP	10.0%
1	MAZDA	ENERGY RADIATED AS LIGHT	0.6%
1	TANTALUM	" " " " "	0.4%
1	GEM	" " " " "	0.3%
1	CARBON	" " " " "	0.2%

the improved quality of the product, the cost of proper illumination becomes all the more insignificant.

Indirect illumination is briefly referred to and its value in libraries, living rooms, auditoriums, offices, draughting rooms, etc., is explained. The recognition also of the necessity for proper window lighting is given some attention. Merchants are coming to realize that they should build good windows and light them well. To be properly illuminated window lights should illuminate the object rather than the eye. The writer finally touches on a very important factor in illumination which is often overlooked, namely, the care of our eyes. As a general rule we illuminate for a pleasing effect or to attract attention, but the paper points out that our sight, which is undoubtedly the finest and most precious of our senses, has a right to receive greater care in the future than it has in the past.

Mr. Henninger illustrated some of the features of his paper by limelight views showing how indirect illumination, semi-direct illumination, and reflectors had been used in different factories, machine shops, stores, store windows, barber shops, and public buildings with very beneficial results.

As the hour for adjournment had arrived discussion on Mr. Henninger's paper was deferred until the following morning.

During the evening a large number of the members and ladies took special cars on the Hull Electric Railway to the Victoria Hotel, Aylmer, where a garden party and dance

CONSTRUCTION OF DISTRIBUTION SYSTEMS FOR OUTLYING DISTRICTS AND SMALLER PLANTS

By S. Bingham Hood.

This paper covers the subject in a very comprehensive way. It is pointed out that the operation of the complete distribution system by one company possesses many advantages over a duplication of equipment. Figures are given showing the investment costs and the maintenance charges of different kinds of poles. The most approved methods of secondary distribution are discussed at considerable length as also such sub-sections as pole fittings and hardware, and the joint use of poles by different companies. The usual practice for light distribution is now by single-phase sub-feeders, either balancing on different phases at the main bus-bar, or at selected points on a three-phase feeder line. For power distribution recent developments have shown that up to 15 h.p. multi-phase currents are not necessary. Considerable space is given to the description of transformer connections and a diagrammatic description of an ideal distribution is shown.

Discussion

This paper was discussed at some length. Mr. A. B. Lambe considered that the question of joint poles, which had been spoken of by Mr. Hood, was a very important one, as, if some arrangement could be made, a great deal of money could be saved, and, besides, the streets improved in appearance. He asked the writer what was the objection to grounding by some of the water pipes. The writer had spoken of transferring the load of a faulty phase to good ones, and he asked how he would disconnect several hundred services and transfer them to another wire, as this would take considerable time.

Mr. F. T. Stocking, commenting on Mr. Hood's paper, said that there were some points to which exception might be taken, and instanced the superiority of eastern poles over western poles for suburban work. The writer's remarks on concrete poles, he thought, were very much to the point, and there was little doubt that the treatment of cross-arms with a good preservative was a paying investment, and the same remark applied to the galvanizing of hardware. He thought the pin mentioned was a good idea provided the centre of the groove on the insulator came opposite a point below the top of the pin where it would not tilt. He thought also that the method of using auto-transformers as described would result in considerable income but care would have to be taken in making the grounds.

Mr. Mudge also thought that much might be done in regard to joint pole construction, and instanced a case where three companies had got together, doing away with a considerable number of poles, thereby adding to the appearance of the streets. He thought the paper was a little too strongly in favor of 25 cycle lighting and a little too optimistic as to its being satisfactory but if one got up to 27½ cycles the objection disappeared. He knew of claims having been made of injurious effects to the eye in connection with low frequency lighting.

Mr. Hood in replying said that there was no doubt if there was a basement that was the proper place to bring the wires in. In his opinion there was no use in running a ground wire down the outside of a house as was mentioned in the National Electric Code, when a ground could be made in the basement. As to the transferring of the defective three phase circuit from one phase to the other two good ones he was referring to a feeder made with three or a multiple of three distributions. It was a simple matter to cut it out with a jumper and required only three or four feet of wire. With regard to the 25 cycle lights, Mr. Hood said he had gotten very good results from it, especially under certain conditions.

The Convention adjourned till the following morning.

Executive Session

At 2.30 p.m. the members of the Executive met and elected the following officers:—

President, R. F. Pack; 1st Vice-President, W. L. Bird; 2nd Vice-President, R. H. Sperling; 3rd Vice-President, J. S. Norris; Hon. Secretary, T. S. Young. Managing Committee: A. A. Dion, W. C. Hawkins, A. L. Mudge, H. G. Matthews, W. L. Adams, F. A. Chisholm, I. H. Wright, D. R. Street, P. H. Kemble, Wills MacLachlan, D. H. McDougall, E. L. Milliken, H. B. McDunnough, W. Phillips.

During the meeting the President read a telegram from Mr. Samuel Insull, of Chicago, regretting his inability to attend the convention and hoping that it would be a great success.

In the evening a banquet tendered by the Local Committee was held in the Banquet Hall of the Chateau Laurier and a very enjoyable evening was spent.

Morning Session (June 21st)

The Convention met in the auditorium of the Family Theatre at nine o'clock a.m. in order that moving pictures might be shown illustrating the paper on "Underground Construction." Before Mr. Gest's paper was taken up the President asked Mr. Baker, of the Canadian Westinghouse Company, to give his paper on "Watthour Meters, Past and present."

WATTHOUR METERS—PAST AND PRESENT

By C. W. Baker.

This paper outlined the history of meter manufacture from the first instrument built by Faraday in 1831. Special attention is given to induction watthour-meters which are described fully under the sub-heads of the moving element, the register, bearings, permanent magnets, magnet clamps and adjustments, electro-magnet, sequence of events, friction compensation, mounting and testing. Polyphase meters are explained with reference to their relation to single-phase meters and a paragraph deals with the method of reading the average power factor of three-phase circuits. The paper is printed in full elsewhere in this issue of the Electrical News.

Discussion

The discussion was opened by Mr. H. S. Brown, who stated that there seemed to be some difference of opinion among meter designing engineers with regard to some of the mechanical features. One was upon the question of registers, some designers placing the worm gear reduction at the shaft of the meter while others placed it at the third or fourth position in the reduction. Another point brought out was the use of steel spindles in the register; while steel to brass made a better bearing than brass to brass there were other conditions which some engineers thought more important than low friction, such as constant friction or initial low friction. He thought the lacquering and dipping could not be successfully applied to the bearings in a register. Under some conditions he thought the ball bearing offered advantages over the ordinary pivot bearing, but this was considered by some as only a theoretical advantage on account of the impossibility of producing a ball which was a perfect sphere. Extensive tests, he said, seemed to indicate that the ball bearing was the exact equivalent of the pivot bearing as regarded friction.

Mr. A. B. Lambe discussing the statement of commutator meters being used on a.c. or d.c. without calibration, or practically so, objected for the reason that some commutator meters had tremendous errors when calibrated on a.c. and used on d.c., especially the older type, and even

the modern meters had an error of from two to five per cent. which was too much to let go on top of the original error which might be there. He said that in the Inland Revenue Department, with which he was connected, they were trying to some extent to discourage any combination meter of that sort, and asking that a meter should be calibrated for the exact circuit on which it was to be operated. He stated that personally he was very much opposed to the type of polyphase meter for balanced circuits coming from Europe, although it was all right for a certain class of work. Mr. Lambe also referred to the difference in the design of polyphase meters.

Mr. Webber, continuing the discussion, said that as central station men they could not over-estimate the benefit of the paper. He felt it was a great advantage to get in touch with the manufacturer and hear about any new designs which were being brought out. The central station man can then decide on the style of meter he wants to get. Mr. Webber also called attention to the fact that all the earlier types of meter led up to the latest type of induction meter, and he was pleased to see how the manufacturers had worked it out so that to-day a meter could be procured which a few years ago was not even thought possible. Mr. Webber thought that the central stations ought to try to test the d.c. meters a little more closely. The central station, he said, had been trying to eliminate the ampere-hour meter for some time, and now they were not legal in Canada. He had been interested in some tests which had been made with ball bearing meters, and the best results seemed to be where the bearing had been saturated with oil.

The President said he thought it was a good thing to have a meeting where the manufacturer, the central stations and the Government could get together and exchange views. He thought the Department was honestly trying, without injustice to the manufacturers, to obtain standards on some features, which he considered was a very important matter.

Mr. R. Hornby gave some very interesting information as to the evolution of meters in Europe. He said he was very much in sympathy with the idea of either making the balanced-load three-phase meter in-admissible or in some way making it a distinctive meter. Mr. Kemble and Mr. Pratt also discussed the paper.

Mr. Baker, in closing the discussion said with reference to placing the worm on the first shaft instead of the third of fourth, if the friction could be reduced in the movement that the meter had to drive it was an advantage, that when it took so much power a small variation in the friction seriously affected the calibration. He recognized that while the ball could not be made a perfect sphere yet the surface and density and polish could be made almost perfect. He wished, he said, to take exception to the view that had been expressed in different quarters that the ball did not rotate, as it had been found it did not rotate, and was therefore much better than the pivot bearing. He said with regard to testing that unless meters were run under service conditions the test was liable to be inaccurate. In conclusion he referred to a case in which he had had considerable trouble where a balance meter had been used.

UNDERGROUND CONSTRUCTION

By G. M. Gest.

The President announced that Mr. G. M. Gest had found it impossible to be present, but Mr. H. H. Stannard would take his place. Mr. Stannard said that his paper on "Underground Construction" would take the form of moving pictures, which would need no explanation from him. Before the pictures were exhibited Mr. Stannard referred to the immense stretches of pipe lines used by the Standard Oil

Company and the conduits of the Bell Telephone Company, and the question of putting wires underground was rapidly coming to the front. The moving pictures showed the operation of putting down conduits and cables in different parts of the world. Scenes were also shown of power plants, and overhead wiring in different places.

The next item was the reading of a paper by Mr. McAllaster Moore, of Belleville, on "Commercial Electric Heating" which called forth considerable discussion. The President referred to some experiments he had tried with an electric cooking apparatus, but owing to the low cost of gas and some difficulties in getting proper operation the experiment had not been very successful. On the contrary Mr. MacLachlan said in his experience he had found the electric heater to work very well and he found his bills were lower than when he had used gas. Mr. Kemble thought some attention should be given to the development of business which would take current during the night hours, and that the cooking system and hot water heating system might be profitably worked up.

COMMERCIAL ELECTRIC HEATING

By McAllaster Moore.

The writer expresses the opinion that electric house heating will never become popular. It is calculated that three lbs. of coal are required to generate one boiler h.p. and calculating coal at \$5 a ton, it would be necessary to sell electricity at 1/15 of a cent per kw.h. or \$4.38 per h.p. year to compete with steam heating. Where coal is much more expensive, however, and heating plants much less efficient and where the cost of operation is high there are already many instances where electric heating is cheaper than steam. This is especially so where use can be found for the electric energy during the summer months.

The paper describes at length numerous instances where electric heating has come to be recognized as highly advantageous. In the tailor shop, in the glue factory, where soldering irons are required, for sealing-wax pots, for the electric pitch kettle in brush factories and places of similar nature, it is pointed out that electrical appliances are not only advantageous but safer and cheaper.

The value of the electric baking oven is exemplified at some length. This type of load is the most desirable that a central station could possibly have. Bakeries use their ovens at a time when the current is not required for other purposes, namely, between 12 at night and 6 in the morning.

As a means of heating water the writer does not hold out great hopes of successful competition with the ordinary methods unless in such cases as apartment houses or very large residences.

Nothing remarkable has recently developed in the way of electrical apparatus. Advance has rather been along the line of perfection of the apparatus already in use. A note of warning is sounded against the salesman of electrical equipment becoming over-enthusiastic before studying any particular customer's requirements. Over-confidence, which has resulted in mistakes, has led to distrust of and injury to the electrical industry. The paper points out the absolute necessity for making reliable and permanent installations of whatever kind. This is illustrated by reference to the trouble often met with by users of electric irons, from broken chords, blown fuses, or burnt sockets. The additional cost of running permanent lead wires with pilot lamps to indicate when and where the current is in use, may seem considerable in some cases, but is money well spent in extra satisfaction in service and in lower maintenance charges.

Mr. C. Thomas suggested with reference to the cost being somewhat higher than gas that it should be taken into consideration that the electric cooking saved a considerable percentage of the material cooked. This point, he

thought, was not generally considered, but was an important factor. Mr. Hornby said in England considerable advertising was done contrasting the well fed man who used the electric apparatus with the poorly fed man using the gas stove.

Mr. Moore, in closing, said that Mr. Kemble's idea of the storage capacity of cast iron for taking care of heat was very good, but it was rather offset by the expense. His practice had been to use an ordinary range boiler with an asbestos jacket. He said notwithstanding some difficulty in getting servants to use care in the management of the heater he had found it to work very satisfactorily.

The President next introduced Mr. Thos. F. Kelly of the Hamilton Electric Light and Power Company to read his paper on "New Business."

NEW BUSINESS

By Thos. F. Kelly.

The sale of electricity, the paper states, must be regarded in just the same way as the merchant regards the sale of any commodity which he undertakes to supply to the people whose patronage he seeks. The article or service to be sold must meet the expressed or latest needs of the people to whom it is offered and must be of real value to those who purchase. While the price at which electricity is sold must also be such as to afford a reasonable profit, the rates must not, if the business is to be successful, be so excessive as to limit to any extent the volume of the sales.

It is pointed out that there is both profitable and unprofitable business and that it should not be the aim of salesmen simply to get business. The well-managed company will discriminate and leave the unprofitable business to the competitor.

Much depends on the quality of the commodity to be sold. It follows that the service must be reliable, which means that the equipment for generating and distribution must be of the best. Installations should be promptly made; inspection should be regular; complaints should be instantly met and adjusted; all customers must receive courteous treatment. Much depends on the type of man who goes out for new business; his conduct and performance should always be such as to advance his company's interest. The solicitor should feel thoroughly the responsibility and dignity of his position; he should endeavor to acquaint himself with all details in connection with his business before approaching a customer. He must, if possible, have special aptitude for the work, should be a fair judge of men, have a business address and be enthusiastic.

The solicitors should be entirely familiar with the class of business they are endeavoring to secure, with the territory they are supposed to cover and be acquainted with what has and will happen in this territory. They should be connected with all local associations giving them an opportunity of getting in close touch with the proper men. It is believed that this type of business might be divided into sections, such as electric power, electric lighting and electrical appliances.

The solicitor should always look for and receive assistance from the office department. All inquiries for service at the office should be turned over to the solicitor with any information that may be gleaned in any way. The writer is of the opinion that advertising is a very important part of the business campaign. Before embarking on any particular line of sales, be it electric signs, electric vehicles, electric irons, advertising should precede active work on the part of the solicitors. Some useful hints are given on the best methods of advertising. It is especially emphasized that advertising should be honest and that it is well to keep good friends with newspaper men.

In order to be sure of securing the new business the

soliciting department should be in direct communication with the building inspector's office, the architect, the contractor, the owner of the new building. It should be the solicitor's business to see that the house is properly wired and then to see that the first tenant installs lighting and other equipment.

It will assist the head of the business department if he is actively connected with the board of trade and if he is a friend of the commissioner of industry and he may well be active in bringing new industries to the town or city in which he is working.

The article closes with some helpful general comments on the methods of securing business in the different classes of residence lighting, electrical advertising and electrical appliances. In connection with residence lighting it is recommended that the wiring of houses and the supplying of fixtures might often be carried out on the instalment basis. This plan is also recommended in connection with the use of electric signs. Many a householder or merchant is able and willing to pay a small monthly rental when they would not consider the payment in one lump sum.

Discussion

The paper called forth an interesting discussion in which Mr. Kemble, Mr. MacLachlan, Mr. Hornby, Mr. Marshall and others participated. During the discussion the point was brought up as to the wisdom of owning and maintaining signs, those taking part in the discussion seeming to think that it was a better policy to place the advertising with an advertising company, and let them look after the signs. Mr. Dion said that while he agreed with this view yet it was necessary for the companies to see that the signs were kept in proper shape, and he had found that a proposition placed before the advertisers for a certain sum to renew the signs when out of repair usually met with favorable consideration.

The President announced that any member desiring to contribute to the discussion could do so by writing the secretary and it would be incorporated in the report. The convention then adjourned till the afternoon.

Afternoon Session

The President called the meeting to order and stated that the meeting was open for the discussion of Mr. Stannard's paper on underground construction. Mr. Stannard being absent the paper was not discussed except that a number of those present expressed their appreciation of the pictures which had been shown.

Mr. D. H. Ross then read his paper on "Power Factor—Its Influence and Effect."

POWER FACTOR, ITS INFLUENCE AND EFFECT

By D. H. Ross.

Little attention has been paid to the importance of high power factor and the necessity of including it as a basis of rates which will be fair not only to the operating company, but to the many classes of consumers as well. The recent invention of unity power factor motors has turned the attention of the operating companies to the possibilities of saving in cost of service, reduction in over-head charges, etc., to be derived by improving the power factor of their systems. For example, consider that to supply a given kilowatt load at a low power factor involves:

- (1) Unnecessarily large, and hence, expensive generating machines, which are rated according to their current capacity.
- (2) Similar expense in generating station, transforming and switching equipment.
- (3) Large increase of transmission line, copper cost and distributing transformers.

- (4) Increased core loss in transformers.
- (5) Poor regulation of generators on low power factor.
- (6) Underloaded prime movers, hence unnecessary capacity and decreased efficiency in their operation at low loads.
- (7) Increased maintenance charges due to size and, in many cases, number of units of transformers, switch gear and transmission.

The actual reduction in generator capacity as the power factor is reduced is shown in Fig. 1. The lower curve shows the number of 5 h.p. motors which may be operated from a generator of 250 k.v.a. capacity at the different power factors. Note that at 100 per cent. power factor the generator will drive 50 five h.p. motors, but at 50 per cent. power factor 25 motors only may be carried on the generator and transmission system. Note also that the generator load has increased from 250 to 270 k.v.a., due to the effect of poorer regulation at low power factor.

Not only does the actual productive load to be carried decrease with low power factor, but there is also a decrease in efficiency of the generating station, as the field loss is greater owing to the increased excitation, and the exciter sets are either overloaded or larger than is necessary. A serious effect of power factor on the regulation is also noticeable and it is interesting to note, Fig. 2, that while even the slightest increase in power factor is highly desirable, it becomes increasingly important as unity is approached.

From these considerations it is evident that power factor and costs of service are very intimately related, the cost depending almost proportionately one on the other in a water power development as also in a steam plant, except for the extra cost of coal. The question is asked whether all

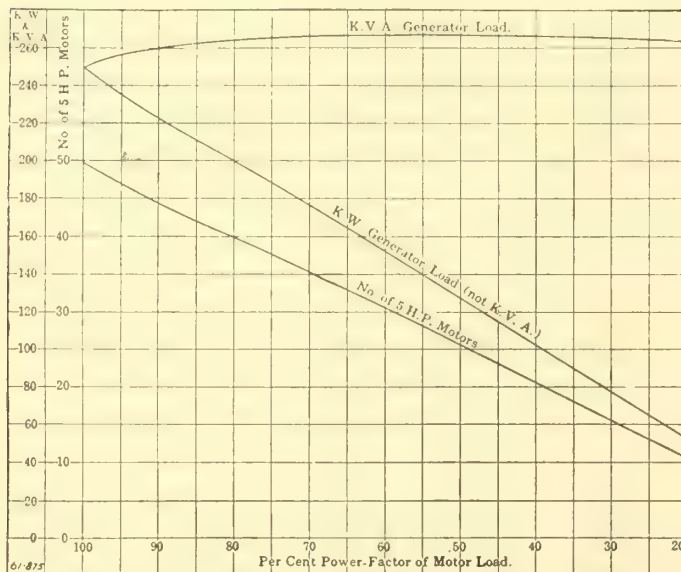


Fig. 1—Effect of Power Factor on Generator Capacity.

rate schedules should not contain a power factor clause which would require the customer with the low power factor to pay for the increased losses and investments as previously listed? The consumer when he finds it to his advantage will install high power factor apparatus, and will pay an equitable amount for the power he receives.

This state of affairs has been made possible by the production of a unity power factor motor which has been recently placed on the market and marks a radical step forward in the design of single phase machines. Curves of the performance of this motor are shown. Running idle, the motor draws a leading current of 30 per cent., which falls off rapidly as the load comes on, and is practically unity from half load to load and a half. In cases where it is desired, the motor can be connected over-compensated, i.e.,

it will give a leading current of 5 per cent. to 10 per cent. at full load, and 40 per cent. to 50 per cent. running idle. The slip is practically negligible, being about $1\frac{1}{2}$ per cent. at full load. This motor is not radically different in operation from the repulsion type motor, i.e., it is started by simply throwing in a two-pole single-throw line switch, and the motor automatically takes care of the rest.

Many power companies now recognize that single-phase distribution is the most economical for the smaller custom-

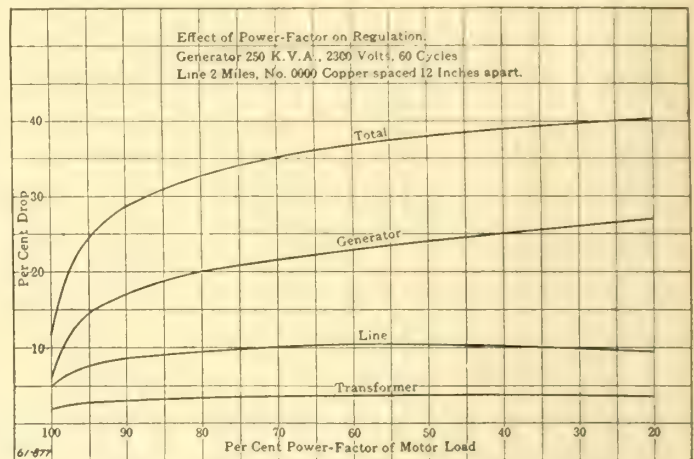


Fig. 2—Effect of Power Factor on Regulation.

ers, and make it a rule that all installations of less than $7\frac{1}{2}$ h.p. will be single-phase. Accepting this as correct from an economical and engineering standpoint, the importance of unity power factor motors will be inestimable as a means not only of saving to the central station in installation, maintenance, metering, etc., over a polyphase installation, but in maintaining a system of practically unity power factor.

Discussion

Mr. Mudge stated that any device which had the effect of bringing up the power factor should be very carefully investigated. Mr. Hood agreed that it was a very important matter and was one worthy of investigation and study. Mr. Kemble and Mr. Dion followed expressing their appreciation of the paper, and Mr. Kramer asked the writer of the paper if he had time to go into the construction of the motor, to which Mr. Ross replied that he thought it would take too much time, but that a paper had been given before the National Electric Light Association last year which would give the desired information.

Mr. Kemble then read his report as Chairman of the Committee on "Rates and Forms of Contract."

The President complimented Mr. Kemble on the good work the committee had done.

The next item was the reading of the report on "Uniform Accounting" by the President, Mr. Street being engaged elsewhere.

The report of the Public Policy Committee was handed in, but not read. Mr. Pack stated that the duty of this committee partly was to give advice and help to any company in trouble, and the committee would be glad to receive any enquiries from any company in this regard.

On motion of Mr. Pack, seconded by Mr. Kemble, the naming of the standing committees and naming of the next place of meeting was left with the incoming Managing Committee.

The meeting closed with hearty votes of thanks to all those who had contributed to the success of the Convention, special mention being made of the President, Mr. Dion, and Colonel Street, chairman of the Banquet and Ladies' Committee. The members then left to see the base-

ball match between the Manufacturers and the Operating Companies. A successful smoking concert was held in the evening.

Convention Features

On all sides one hears nothing but appreciative enthusiasm of the magnificent hospitality of the citizens of Ottawa, who gave most liberally of their time and money to make the Convention proceedings a success and the social functions a delight. Too much credit cannot be given to Mr. A. A. Dion and the other members of the Local Committee. Colonel Street, as Chairman of the Banquet and Ladies Committee, was an indefatigable worker. Contributions to the Convention fund were most generous. It is sufficient to say that Ottawa has established a record for hospitality that will long withstand the test of competition and has given to the visiting members of the C. E. A. experiences of happy days that will linger long in their memories. Mr. W. H. McIntyre was Chairman of the Drive Committee; Mr. G. G. Gale of the Aylmer Committee; Mr. P. M. Grimes of the Ball Game Committee, and Mr. A. B. Lambe of the Smoker Committee. Members and visitors wearing the Association badge were carried free on the cars of the Ottawa Electric Railway and the Hull Electric Railway.

The banquet Thursday evening was a brilliant affair. About three hundred persons were present. The frontispiece of the menu card bore a maple leaf, embossed in gold, with the letters "C. E. A." a splendid illustration of the beautiful Chateau Laurier, and the words "Coming-of-Age Banquet of the Canadian Electrical Association." After the toast to "The King" came "Our Country," which was responded to by the Honorable Charles Murphy. Controller Hinchey and Mr. O. Higman replied to the toast of Our Capital, and Mr. R. F. Pack to Our Association. Mr. Pack pointed out, briefly, what he considered the true functions of a public service company. The good will of the people was the most valuable asset, and one of the main objects of the Canadian Electrical Association was to have this idea carried out. "To-night we are cheering for the Association, to-morrow let us work for it," was Mr. Pack's closing remark. Mr. J. H. Cornish and Mr. Baker, Publicity Commissioner of Ottawa, spoke for "The Ladies."

President Dion was taken completely by surprise when presented with an illuminated address, accompanied by a cabinet of silver. The presentation was made by Mr. G. C. Keyes on behalf of the employees of the Ottawa Electric Company, and the demonstration which followed left no room for doubt as to Mr. Dion's universal popularity.

By a unanimous resolution of the Convention, a cablegram containing hearty greetings was sent to Mr. R. G. Black, who has been in Europe for the past nine months and who was absent from the convention for the first time in many years.

A massive maple leaf over the offices of the Ottawa Electric Company was one of the many evidences of the welcome extended to the C. E. A. visitors.

Every visiting lady was presented with a specially engraved souvenir spoon, the gift of the Ottawa members.

The baseball match resulted in an easy victory for the Central Station representatives.

Steel Surface St. Ry. Train

In Fig. 1 is shown what is believed to be the first steel surface street railway train operated in America. The train is in daily service on the Frankstown Avenue line of the Pittsburg Railway Company. The motor car is equipped with four Westinghouse No. 306 interpole motors, 50 h.p., and HL control. This car has been in operation since January 20, 1911, and has averaged approximately 130 miles daily since. There have been no control failures of any consequence during the period. The design is due to Mr. P. N. Jones, general superintendent of the company. The hand-operated rear-door opening device is so arranged that the doors open inward over a stationary step. There is no folding step with hinges to cause accidents or to wear out, and there is no grab handle or step exposed when the door is closed. No part of the door extends beyond the side of the car. The front door slides, is air operated and is controlled by a small valve just above the hand brake wheel. Accidents with these cars have been reduced to a minimum due to the fact that the steps are entirely enclosed while the cars are moving.

The most noteworthy feature of the steel trailer shown in Fig. 1 is that the boarding step of the centre door is very low which facilitates rapid loading and unloading. The train is used in the evenings as a "Theatre Special" to carry passengers from theatres in the city to Wilksburg, one of the suburban boroughs.

The motor car is of Brill manufacture and is of a unique design developed by the railway company. Its weight, including trucks and equipment, is 46,000 lbs. The seating capacity, including that of the folding seat on the rear platform, is 61 persons, giving the low weight per seated passenger of 754 lb.



Fig. 1—Steel Surface Train of Pittsburg Railway Co.

Watt-hour Meters—Past and Present

By C. W. Baker

In 1831 Faraday built an electric machine which consisted of a square of wire so mounted as to rotate about an axis at right angles to the earth's magnetic field. The current was brought out to a two-part commutator and collected on two wire brushes. This machine delivered a very weak fluctuating uni-directional current which was detected by means of a galvanometer such as was then used to detect currents from batteries, battery currents having been known from Galvani's time some forty or fifty years previous.

About fifty years later (in 1883) Foucault observed that a copper disc when rotated between the poles of a permanent magnet was retarded by the magnet, also that the disc soon became warm; and so he discovered the existence of eddy currents in the disc. We now call these "Foucault" currents in recognition of his work. Practically all watt-hour meters of to-day have exactly this combination, a copper or aluminium disc rotating between the poles of one or more permanent magnets.

Ferranti, in the same year (1883) built a motor meter. An iron core was provided with a shallow cup, at the top, in which mercury was placed. A magnetizing coil, placed around the core, carried the current, which in turn passed into the mercury all around the periphery and out at the centre. When the load was connected, the core became magnetized, the magnetic lines of force passing up vertically through the mercury. The current, flowing radially in the mercury, was at right angles to the magnetic flux, and so caused the mercury to rotate. The cup was roughened so as to offer greater resistance to the motion of the mercury. The rotating motion was transmitted to an integrating train of gears by means of a small fan placed in the mercury.

On March 18th, 1888, Galileo Ferraris gave the first clear enunciation of the principles of the rotating magnetic field with which we are now so familiar in the induction motor and the induction meter.

Electrolytic Meters

Electrolytic meters are fundamentally ampere-hour meters, and the charge for power is based on the assumption that the voltage of the circuit is constant. St. George Lane-Fox was the first to describe the electrolytic meter. Later Edison developed his voltameter,—a shunted electrolytic cell in which 1/1000 of the total current passed through the cell; the rest of the current passed around by way of a low resistance shunt. A copper wire of a certain length and size was placed in series with the cell to compensate for the heating effect of the current in the cell. The amount of current, i.e., the coulombs, or ampere-hours, was determined by the number of grams of metal carried from the anode to the cathode in the cell. It was a long slow process to weigh the two metal plates from each meter, and it is little wonder that the voltameter was soon discarded in favor of other and newer types of meters.

Commutator Type Watt-hour Meters

The Thompson recording wattmeter, or watt-hour meter, as it should be called, is the best known commutator type meter. It was the prototype of all d.c. watt-hour meters, except perhaps those of the mercury motor and clock types.

A watt-hour meter is a motor generator set with a revolution counter to count the revolutions of the shaft. In commutator type meters, the motor (series coils and armature) is of the shunt-wound type. (Using a series-wound motor would give us an ampere-hour meter, not a watt-hour

meter). The generator is the copper or aluminium disc rotating between the poles of the drag magnets and generating eddy currents within itself as discovered by Foucault (in 1883). The revolution counter is the integrating train of gears.

In designing a shunt motor, we make the armature resistance as small as possible, and the back e.m.f. as large as possible. In a meter the resistance of the armature circuit is so large that the back e.m.f. generated is entirely negligible. An appreciable back e.m.f. would cause the meter to run slow on overloads. These meters may be used on either d.c. or a.c. with about equal accuracy, unless the frequency is very high. For 125 or 133 cycles, it is necessary to re-calibrate.

For use on a.c. circuits of low power factor, a non-inductive shunt is placed across the series coil to compensate for the reactance of the armature.

The wound armature, the armature supports, the necessarily long shaft, the drag disc and the commutator make the moving element large and heavy. This, of course, adds very much to the friction and wear of the lower bearing—introducing a rapidly increasing friction as time goes on. There is also the variable friction of the brushes to contend with, giving a variable light load performance. Hence it has become the accepted practice to make light load check readings at 10 per cent. of rated capacity. For induction meters, this check is usually made at five or four per cent. of rated capacity.

Ampere-Hour Meters

The first ampere-hour meters were of the electrolytic type. Then came Ferranti's mercury motor type mentioned above. About 1893 O. B. Shallenberger designed the well known Shallenberger ampere-hour meter. This is an induction type meter. The current carrying parts are all stationary. The moving element consists of a shaft carrying a small aluminium disc with an iron ring around its periphery and a four-vaned fan mounted on the shaft below the disc to act as a brake or retarding device. The integrating train is similar to that used in modern watt-hour meters. A few ampere-hour meters are still in use in connection with watt-hour meters where a better rate is given for keeping the average power factor high. From watt-hour meter readings, ampere-hour meter readings and assumed constant voltage, the average power-factor is figured. This is a very rough method, and better methods are available.

Clock Meters and Oscillating Meters

These are two types of meters which are decidedly interesting on account of their novelty. The clock meter, made by H. Aron, Berlin, Germany, has two pendulums driven by clockwork. Each pendulum carries a shunt coil and below each pendulum there is a series coil. The polarity is arranged so that one pair attracts and the other pair repels. These forces, aiding and opposing gravity, cause the one pendulum to run fast and the other slow. The difference in the number of swings they make is registered through a differential gear which operates the dials. "Creeping" is prevented by reversing the direction of the clockwork every 10 minutes, and at the same time reversing the polarity of the shunt coils. This eliminates any errors due to the two pendulums having slightly different natural periods.

The oscillating meter (Electric Co., London), is novel in that its moving element oscillates rather than rotates. At

the end of each oscillation a moving contact operates a solenoid which reverses the polarity of the shunt coil and so it starts back on the return trip and continues till it meets the contact at the opposite end of travel.

Alternating current is so universally used in this country and the induction meter is so arranged and so much cheaper than either of the above types, that they are interesting only in passing.

Induction Watt-hour Meters

In the first practical induction type, watt-meters, O. B. Shallenberger placed his series coils in one phase and the

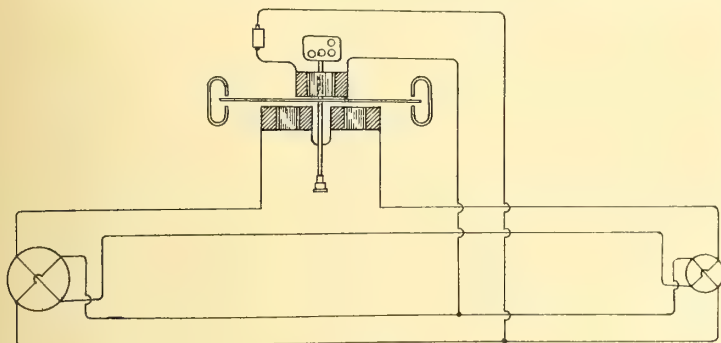


Fig. 1

shunt coil across the other phase of a two-phase system, using a non-inductive resistance in the shunt circuit. He also applied this meter in several different ways, as indicated by diagram in Figs. 1, 2 and 3, Fig. 1 being a single phase meter, Fig. 2 a polyphase meter, and Fig. 3 a single phase meter reading the power in a 3-phase circuit, of course assuming balanced conditions of load and voltage.

The outstanding feature of this meter (as of all induction type meters), is that the shunt current and series current are in quadrature for loads of unity power-factor. This was a radical change from previous practice. Previous meters, being commutator type meters, had their shunt and series currents as nearly as possible in step for loads of unity power-factor.

The next step was the designing of a novel choke coil, covered by a patent taken out by Mr. Shallenberger, which he described thus:—

"It may be stated that by suitably proportioning the amount of iron constituting an interrupted magnetic core, to the width of interruption or air-gap and to the winding

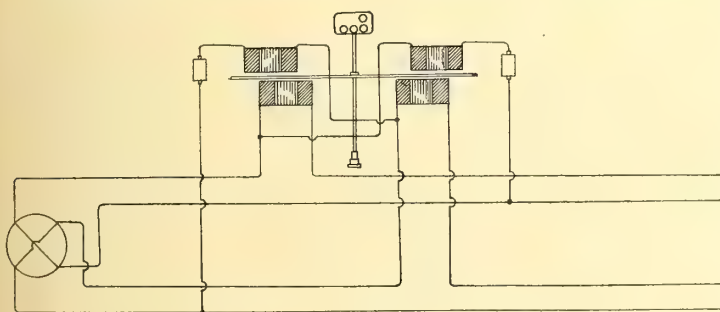


Fig. 2

employed, a lag of approximately ninety degrees in the current behind the impressed electro-motive force may be obtained. Such an inductance coil properly proportioned will also compensate for changes of periodicity so that the inductive effect of the shunt current upon the armature will be proportional to the electro-motive force independently of the periodicities over a wide range. Such a coil should be so designed that the cross section of the iron is sufficient to remain well below magnetic saturation the interruption or air gap in the core being sufficient to require a mag-

netizing force which is large relatively to that required for magnetizing the iron alone, but the iron portion of the core should occupy a sufficient length of the magnetic circuit to secure a high coefficient of self induction with relatively very small loss due to the winding."

This choke coil is an essential feature of all induction type watt-hour meters to-day. A few manufacturers still employ a shunt coil with a separate choke coil precisely as Shallenberger did. The majority combine the choke coil and the shunt coil in one, but the fundamental principle is the same.

There then followed a string of other patents by Shallenberger, Conrad, Bradshaw and others, covering frequency adjustments, meter bearings, light load or friction compensators, etc.

The Moving Element.—The typical induction meter of to-day has for its armature a thin aluminium disc mounted on a short shaft. This, except for the register, is the only moving part of the meter. Consequently the lower bearing has to carry only about $1/5$ or $1/6$ of the weight of that carried by the jewel of a commutator type meter. This reduces jewel wear and friction to a minimum; consequently the accuracy and life of the meter are very much increased.

The Register.—A great deal of attention has been given to the design of the "register" or integrating train. The worm and gear (the crudest part of the train) usually forms the first reduction, i.e., the worm is placed on the top of the meter shaft. It has also been placed at the 3rd or 4th reduction, where it has less to drive and where it runs at a slower speed. Standard clock gearing has been found

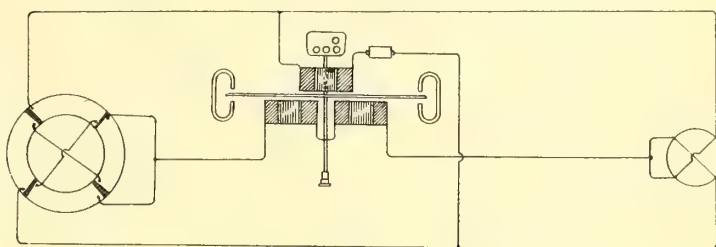


Fig. 3

wanting, so special shapes of teeth have been employed to still further reduce the friction. The good practice of steel in brass has been generally followed for the counter shafts and bearings. Lacquering and plating are both used to prevent the rusting and corroding of parts. The number of change gears, to change the register from one capacity to another, has been reduced to a minimum to facilitate the changing of capacities and to minimize the chances for errors.

Bearings.—A very essential feature is the alignment of the bearings. Some meters are built on punched frames and the alignment of the bearings is usually only approximate. Self-aligning upper bearings are also sometimes used. The upper bearing should be rugged yet sufficiently flexible to absorb the vibrations of the disc and shaft without noise. A perfectly rigid upper bearing would throw a greater amount of this vibration on to the lower bearing and cause greater wear on the jewels and pivot.

Most makers use a pivot lower bearing running in a cupped sapphire jewel. Another type is a steel ball running between two cupped sapphires, while in a modified form of this bearing one cupped jewel is used and the steel ball is set into a conical recess in the bottom of the shaft. This modification destroys the object of using a ball, since it prevents any possibility of the ball rolling on the jewels.

Permanent Magnets.—Permanent magnets are universally used for the "drag" or "brake;" using the principle discovered by Foucault (1883). The disc is driven by eddy currents, and is retarded by eddy currents, so that changes

in the resistance of the metal of the disc affect both sets of eddy currents alike and thus the accuracy of the meter is not affected by the disc changing in temperature. Many magnets are designed to fit into the remaining space in the meter case, and strength and permanency seem to be a secondary consideration. Their physical treatment is just as varied as their shape. The best magnets are ground to a standard length, bent at a definite temperature, and are treated by vibration and by heat to relieve internal stresses and reduce the temperature coefficient. After magnetizing to saturation they are reduced in strength to make them more permanent. This is done by boiling them in oil or

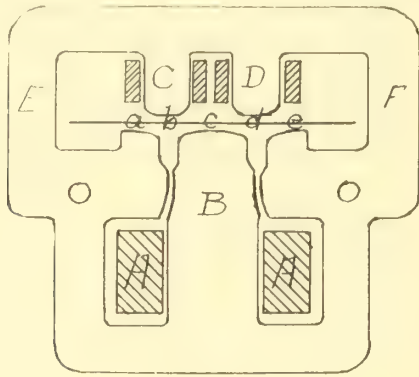


Fig. 4

subjecting them to a d.c. field or to violent mechanical shock or by rotating rapidly a copper disc between their poles and by other methods. The magnets are then given a final ageing for several months to weed out those that have been improperly treated, careful measurements of strength being taken before and after ageing to enable the defective magnets to be picked out.

Magnet Clamps and Adjustments. The calibration of a meter can be no more permanent than the clamping of its magnets. If the magnets move out, say, 2 per cent. of their distance from the centre of the disc, the calibration is changed by 4 per cent. This is because, first, the magnets are now acting on a longer lever (2 per cent. longer), and, second, the portion of the disc between the magnet poles is travelling at a greater velocity (2 per cent. greater), from which it follows that the eddy currents are stronger and the damping effect greater.

Micrometer adjustments are doubly good aside from their saving of time in adjusting the meter, for they conduce to more accurate results, first, because they are capable of finer adjustment, and, second, because they eliminate the tendency of the tester to say, "Oh, good enough will do," when the meter is just within the limits, in fear that the next move may throw the adjustment too far the other way.

The Electro Magnet.—The illustrations, Figs. 4 and 5, are the electro-magnets of two well known makes of induction watt-hour meters. The principles employed are identical. Around the shunt coil "A" we have an interrupted magnetic path, the interruption or air gaps being on each side of the main shunt pole. Nearly all the flux generated by the shunt coil passes across these gaps and so does not cut the disc. So far this is identical with Shallenberger's inductance coil, and, as he explained, the current in the coil is very close to 90° behind the impressed e.m.f. The useful shunt flux is the leakage flux, i.e., that portion of the flux which is crowded out of these gaps and passes up through the disc of the series poles "C" and "D" and back by way of the two lateral paths "E" and "F."

Around the main shunt pole "B" is placed a small coil closed on itself (or a copper ring fitted over the poles is sometimes used). This is the "frequency" or "power fac-

tor" adjustment, and the adjustment consists in shifting the position of the ring, or changing the resistance of the closed coil as the case may be. This closed coil acts as a "shading coil" and retards any flux that passes through it. The flux reduced by the shunt coil "A" is nearly 90° behind the applied voltage, and the leakage or "shunt flux" which cuts the disc must pass through this closed coil and so is still further retarded or "lagged" and can be brought into exact quadrature with the voltage on the coil "A."

The series coils around the poles "C" and "D" produce a flux which passes from one pole to the other by way of the top of the shunt pole "B," and thus the series flux cuts the disc twice, once downward and once upward. This flux is in step with the current.

Sequence of Events.—The series flux being in step with the current and the shunt flux lagging 90° behind the voltage, we see that for loads of unity power factor, the shunt and series fluxes are exactly 90° apart. When the shunt flux is maximum, the series flux is zero, and when the series flux is maximum, the shunt flux is zero. With this understanding and assuming a flux passing up through the disc as a "positive" or "plus" flux and one passing down as a "negative" or "minus" flux, we may lay out the sequence of events in a table, Fig. 6, showing the direction of the fluxes for each quarter cycle. Fig. 7 shows the shunt and series fluxes plotted on a time base with the quarter cycles marked 0, 1, 2, 3 and 4. On figures 4 and 5 the small letters, a, b, c, d and e, show where the fluxes cut the disc, a, c, and e being flux and b and d being series flux. The plotting of Fig. 6 is obvious. You will notice that as we follow down the quarter cycles a plus flux travels from d to c to b to a. This is followed half a cycle later by a minus flux, which is in turn followed at the next half cycle by a plus flux, and so the flux travels across the disc and tends to carry the disc with it. This is analogous to the rotating field of an induction motor cutting the squirrel cage secondary or rotor and causing it to rotate.

In an induction motor, the full load "slip" is 2 or 3 or 5 per cent. In an induction meter, the full load slip is about 95 to 97 per cent.

There is another way of showing why the disc goes round. We may consider that the series flux makes an eddy current in the disc, and that this eddy current is strongest as the series flux is passing through zero, because the strength of the eddy current depends on the rate of change of flux, and this rate of change of flux is greatest

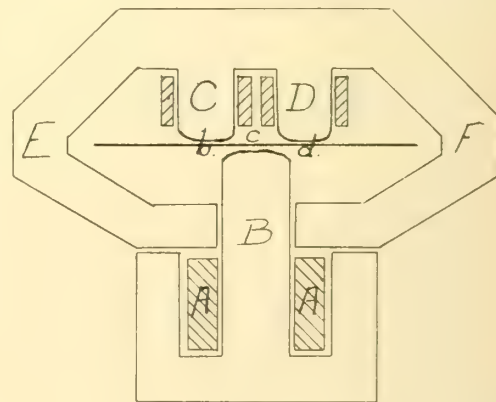


Fig. 5

as the flux passes through zero. Now, as the series flux is passing through zero, its eddy current is strongest, the shunt flux (lagging 90°) is greatest, so the series eddy current acted on by the shunt flux is pulled to one side, and drawn around the shunt flux. As the shunt flux goes to zero, the opposite series flux acts on the eddy and draws it over opposite the series pole. Now it takes work to move a current in a conductor, and this work appears partly

as heat and partly as mechanical energy in the rotation of the disc.

Friction Compensation or Light Load Adjustment.—The fluxes on the iron at each side of the coil "A" will be in phase with each other and so could not alone produce a torque in the disc, but if we place a metal loop or closed coil in the air gap at one side of the shunt pole, the flux passing through the loop will be "lagged" a little and so it will cut the disc a little later than the flux on the other

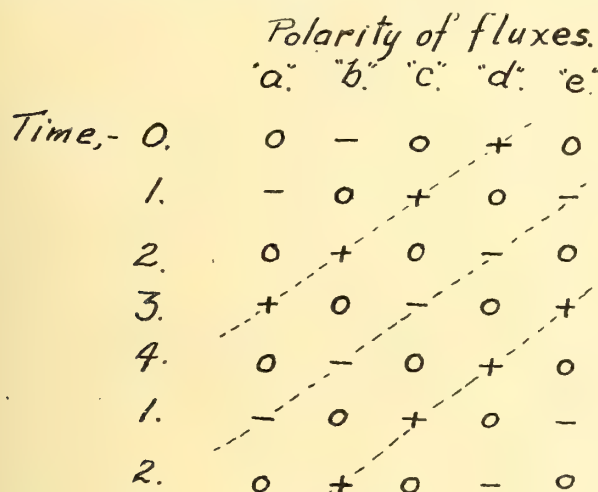


Fig. 6

side. This gives a shifting field which, as we saw above, produces a torque in the disc. By adjusting the position of this loop to enclose more or less flux, we get a greater or less torque on the disc. This is the "light load" or "friction" adjustment. It is preferable to have these friction compensators so located that their adjustment has little or no effect on the frequency adjustment, otherwise the tester must "see-saw" from one adjustment to the other until both are perfect.

Mounting in Case.—The mounting and the case are worth careful consideration. In some meters the series and shunt elements are separate, one being mounted in the cover and the other in the base. This method is not exact enough in the relative location of the shunt and series iron, a very slight error in their relative positions materially affecting the calibration. The best practice is to mount the complete magnetic circuit on a rigid metal casting which also carries all the

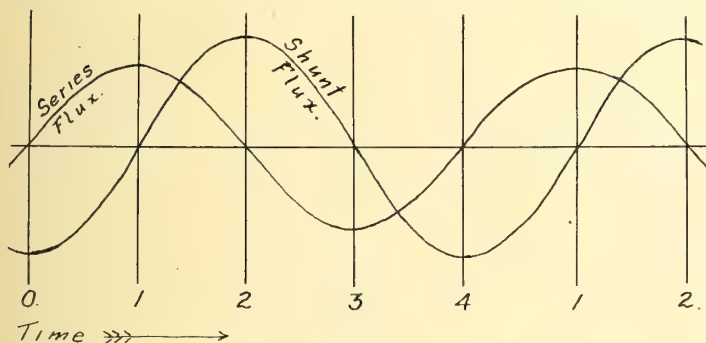


Fig. 7

working parts of the meter. This casting is usually provided with three lugs which register with three bosses or studs in the base. With this construction, the meter may be removed from its base for inspection and then replaced without altering its calibration. Heavy cast iron covers are often used and are, indeed, necessary for some types of meters to shield them from external fields. But in these meters the calibration is affected, by the removal of the cover, sometimes 8 or 10 per cent. This shows an abnor-

mal amount of stray field wandering promiscuously in the meter.

Testing.—It is a common practice to arrange the shunt circuits so they can be separated from the series coil in the terminal box. This is done to cut down the time required for factory testing. Eight or ten meters are connected in series in a row with a standard also in series, and the row is gone over from end to end once for each adjustment and inspection. In cases where this separation of the shunt circuit is not provided each tester has a standard and connects but one meter at a time, making all adjustments and inspection on it. Then he passes it on for registration run where the gears are checked, while he turns his attention to another meter.

Again, there are two methods of setting the p.f. or frequency adjustment. The most generally used method is to employ a choke coil so adjusted as to give about 50 per cent. p.f. The other method is to adjust on zero p.f., or exact quadrature, this quadrature being obtained by using a 2-phase circuit and a small induction regulator connected as a phase shifter. With this arrangement exact quadrature can be obtained and the meter set so its disc stands still. This latter is the better method, since a comparatively small error at 50 per cent. p.f. becomes a large error at zero p.f.

Polyphase Meters

We are all familiar with the method used on test floors for measuring power in a 3-phase line, using two wattmeters and adding or subtracting their readings as the p.f.

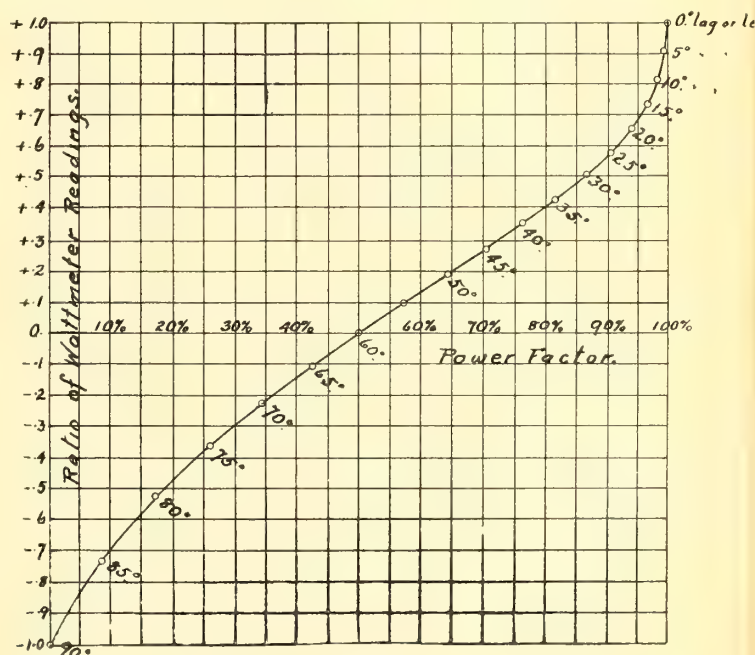


Fig. 8—Power Factor Chart

is above or below .5. A polyphase watt-hour meter is in effect two single phase meters with their discs mounted on a common shaft. The shaft does the adding or subtracting faithfully and without error. Such a meter is used on two-phase or on three-phase lines without changing the calibration. This is identical with the use of two single phase meters to measure either 2-phase or 3-phase power without changing their calibration. This may be explained as follows:—Polyphase meters are calibrated as single phase meters by connecting their series coils in series and their shunt coils in parallel making $2EI$ give full load speed of the disc, where E and I are the full load volts and amperes. Now when used on a 2-phase line each half acts as a single phase meter. The power in a 2-phase line is $2EI \cos \alpha$, $\cos \alpha$ being the power factor, so obviously the meter will

Winnipeg and the Middle West

One of the most imposing of Winnipeg's down-town sky-scrappers will be the ten-storey office building of the Winnipeg Electric Railway Company, on which work has just commenced. The accompanying cut will give some idea of the general appearance of the building as it will be when completed.

The building site is on the corner of Notre Dame avenue and Albert street. The foundations rest on 42 caissons, four feet in diameter, carried down 60 feet to bed rock. There will be a sub-basement, basement and ten storeys above the ground. It will be of steel construction throughout, thoroughly fireproofed, with the first two floors of dressed granite, and the five feet above the sidewalk line of polished granite. The upper floors are finished in terra cotta. The outside will show a novel study in gothic design, and will be outlined at night with electric lights.

The building will be served with three elevators with all the latest devices. The corridors will all have tiled floors with marble wainscoting. A complete vacuum cleaning plant will be installed with connections on every floor. There will also be automatic heat regulating thermostats, and a system of mechanical ventilation. A special study has also been made of the artificial lighting for the building, though, as there is street exposure on three sides of the building there will be an unusually large amount of natural lighting.

The heating equipment will be installed in the sub-basement, and in the basement there will be a ten-chair barber shop, employees' rooms for conductors and motormen, ticket, stock room, record vaults, fan and machinery and switchboard room.

The ground floor will be given over entirely to public offices for the power, light and gas departments of the company. The second floor will be devoted to the company's private offices, there being here offices for the manager, the secretary-treasurer, the purchasing agent, the general superintendent, the board room, and the engineering department. The remainder of the building will be rented for general office purposes. Pratt & Ross, of Winnipeg, and Charles S. Frost, of Chicago are the architects. The general building contract has been let to the Carter, Halls, Aldinger Co., of Winnipeg, and for the foundations to E. C. and R. R. Shankland, of Chicago. It is expected to have the first three floors completed by the first of March, 1913, and the remainder of the building by May 1st.

In addition to the office building which the Winnipeg Electric Railway Co. is putting up, they have also under construction a number of other buildings, among which the more important are the following:

Contracts have been let for a four-storey warehouse and garage on the corner of Fort street and Assiniboine avenue directly opposite the company's old steam station with 80 ft. frontage on the former street and 122 ft. on the latter. This building will be of reinforced concrete and thoroughly fireproof, all windows being of wire glass with hollow metal frames and doors being the sliding fireproof type. This building will be the headquarters for the gas and outside electrical construction. The basement will be devoted to

general stores and pipe work. On the first floor will be a nine car garage for the repair and emergency trucks and for the motor trucks for the gas stove and meter departments, a room for chauffeurs, for the government meter inspectors, for the linemen, for gas and electric meter repairs and stores, offices for the meter department, and for the superintendent of overhead construction work. The upper floors will be used for general storage purposes and will be served by a freight elevator. The building will be



10-storey office building of W. E. Ry. Company

heated by steam from the power house across the street. Pratt & Ross are the architects and Lyall Mitchell are the general contractors. It is to be completed by the end of September.

A reinforced concrete stable and warehouse is under construction in Fort Rouge at the south end car-barns. This building will be 80 x 67 feet and two storeys high, and have twenty stalls, a box stall, feed and harness rooms, and a wagon shed, 34 by 60 feet on the ground floor. The win-

dows and doors are fireproof, and are provided with storm windows and fly screens and the stable will be complete with all modern accessories. It will be heated by a hot blast system of forced ventilation. Pratt & Ross are the architects for this building and Lyall Mitchell are the general contractors. It is to be completed by the end of September.

In addition to the above buildings, the company is also making a large addition to their north end car-barns. This will have six tracts, five of which will have repair pits 125 feet long and will provide additional accommodation for 22 cars making a total car capacity of this barn of 60 cars. This building will, like the old section, be constructed of reinforced concrete and steel with brick walls, and will also provide increased accommodation for inspectors, motormen and conductors. There is also a large amount of other building construction under way in the shape of new substations, additions to old stations and to the gas plant.

New Winnipeg Motor Generators

The city of Winnipeg has recently put into service two 500 kw. synchronous motor-generators at their King street sub-station, each set consisting of a synchronous motor, direct-current generator and exciter. The machines are direct-coupled to each other and provided with three pedestal bearings on combined bedplate as shown in figure. Each motor output is 750 h.p. on a three-phase, 60 cycle, 2200 volt circuit at 720 r.p.m. Each generator is compound wound, provided with commutation poles, with an output of 500 kw. at 550/600 volts.

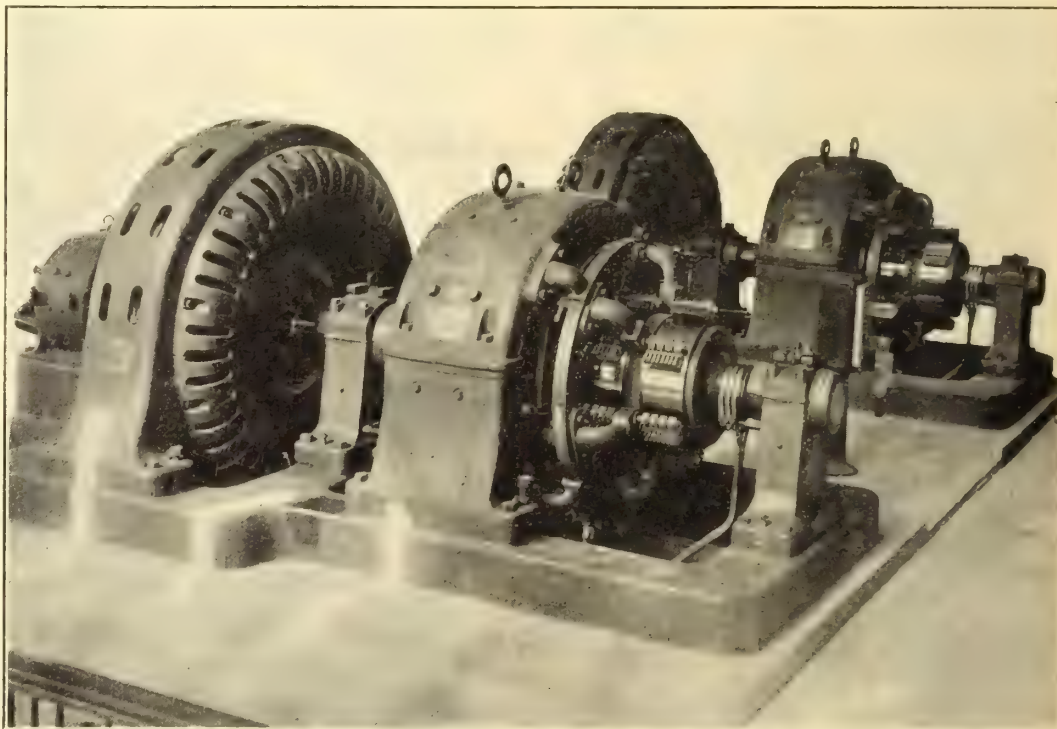
The two piece commutator construction is noteworthy. The manufacturers use this arrangement where the length of the commutator exceeds 11 inches. The two sections are on the same bolts and connected by lugs so arranged as to form veins and produce a current of air to pass between the two sections. The commutator is the same electrically, but mechanically it is far stronger and in addition has the following advantages, viz.—thorough ventilation, cool running assured, short commutator bars used, distortion due to temperature or mechanical stresses avoided, surface always in good condition, brush spindles supported from middle of short rigid support.

The exciters are large enough to act as motors for starting up the sets. Current for this purpose is supplied by an auxiliary motor-generator consisting of a 35 kw., 110 volt, direct-current generator, direct-coupled to a three-phase, 60 cycle, 2200 volt squirrel cage synchronous motor running at 1200 r.p.m.

All the above apparatus with starter and rheostats was supplied and installed by the Siemens Brothers Dynamo Works.

MacLeod Electric Light System

The town of Macleod has owned and operated a power plant since June 1907. Some years before this a private company operated a small electric lighting plant which gave very unsatisfactory service which decided the town to put in their own plant. The first installation consisted of two 125 h.p. Robb-Mumford boilers, two compound duplex pumps with a capacity of 750 gallons per minute each for water supply and fire protection, and one 110 kw. Allis-Chalmers-Bullock generator 2200 v., 3 phase, 60 cycle, direct connected to a Leonard automatic engine. This plant gave splendid service and in 1909, \$30,000 was further expended in installing two more 125 h.p. boilers and one 300 kw. Western Electric generator, direct connected to a Goldie and McCulloch vertical Corliss engine, 14 x 28 x 30, also a 20 kw. exciter direct connected to a Robb vertical automatic engine. When the service was first connected there was only approximately 800 16 c.p. lamps connected and no street lighting, compared with which there is now over 3500 lamps connected, 15—6.6 amp. series arc lamps for street lighting and a series tungsten system of 60—100 watt lamps with Westinghouse regulator. A day service for power was also instituted on February of this year and approximately 100 h.p. in motors have been connected. There has been no serious interruption in the service since its commencement.



500 kw synchronous motor generators, King street sub-station, Winnipeg

the longest period being only of a few minutes' duration. It has also been successful financially.

In conjunction with the power plant, work has just been commenced on the construction of a \$50,000 mechanical water filtration system. All the machinery in this plant will be driven by electricity.

It is also proposed, when this filtration plant is completed, to install a high-duty electrically driven turbine pump in place of the steam pumps now used for supplying the town with water.

For a town of 2,500 Macleod is up-to-date and progressive in this department and keeping pace with the larger towns and many of the cities of the West. Mr. G. H. Altham, the city engineer, has had the management of these works since their commencement.

Moose Jaw

The electrical superintendent of Moose Jaw, Mr. J. D. Peters, has recommended the installation of a 3-phase system to replace the 2-phase which was destroyed by fire recently; in the fire the generators were the principal loss. It is understood that another 2-phase generator was on order with the Canadian General Electric Company, and in all probability this order will be changed to a 3-phase machine. At present a 1,000 kw. unit will be installed and later a 500 kw. for light loads. These together will carry

the peak load during the coming winter. The electrical superintendent has reported strongly against the municipality entering into the public heating business.

A new scale of wages for motormen and conductors on the Winnipeg Electric Railway recently went into effect which gives an increase of three cents per hour to employees having served over three years, and one cent per hour increase for all others. This means that first year men will receive 24 cents per hour, second year men, 27 cents, third year, 30 cents, and fourth year, 34 cents per hour.

Progress Around the Pacific Coast

Electrolysis

Dealing with electrolysis, allegedly from the rails of the British Columbia Electric Railway Company, which has hitherto damaged the city water pipes to a great extent, City Electrician Woodroffe of Vancouver, has made a report that conditions in this city are vastly improved since the last tests were made. The danger zone has become very much reduced in area, due to an additional return feeder installed by the B. C. E. R. Co., and also due to the fact that an additional sub-station has been installed in the west end at the corner of Twenty-fourth avenue and the Lulu Island branch. The conditions, however, are very serious on Harris street, Hastings street east, and Main street, and something must be done to better them. This can be accomplished, according to the report, in the following ways:

"1. By having all negative feeders removed from the rails inside the dangerous zone.

"2. By having sufficient negative feeders installed in places where the rails are positive to the pipes.

"3. By having additional substations installed so as to relieve the heavy current which now has to return to the Main street substation. I understand that the B.C.E.R. Co. is now building a substation at Earles Road and the New Westminster branch, and this will help matters considerably.

"4. By having better bonding installed on the rails. At present the company is using two kinds of bonds. These are known as the compressed terminal plug and the soldered type. The first does not insure good electrical connection, and the soldered bond is mechanically weak, and liable at any time to be broken. There is a much more satisfactory bond which may be used, both mechanically and electrically.

"5. By having proper inspection given to the bonding, and the latter kept in a good state of repair. This applies more especially at the various tramway junctions.

"If, after the above changes have been made, conditions are not found to be improved, a negative booster should be installed by the company at its Main street substation so as to raise the potential of the water pipes to that of the rails."

B. C. E. R. Publication

A finely illustrated description of the operations of the British Columbia Electric Railway Company, Limited, in and around Vancouver was distributed at the recent National Electric Light Association convention held in Seattle, June 10th-14th. The British Columbia Electric Railway Company not only controls the tramway system in and around Vancouver and Victoria, but is responsible for most of the light and power distribution and for the supply of gas. One

gets an idea of the tremendous western development in the last fifteen years from figures contained in this booklet. During this period the capital of the company has increased from \$2,700,000 to \$30,000,000; the gross annual income from \$320,000 to a little short of \$6,000,000; the population served from 50,000 to 220,000. In the light and power business the output of the generating stations, which fifteen years ago was only 2,000 h.p., now totals 128,000 h.p. and the lamps in service have increased from 28,000 to over 700,000. The tramway system has increased from forty miles to two hundred and eighty-one miles; the number of cars in service from 50 to 700; the number of passengers carried annually from about 3,500,000 to over 60,000,000. The company also operates the gas service and has increased the number of mains from 36 to 139 miles; the number of connections from 2,250 to about 15,000, and the gross annual income from \$113,000 to five times that amount. For the month of March, 1912, the total payroll of the company covered 5,086 employees, the amount of the payroll being over \$390,000.

Generating stations are located at Lake Buntzen, at Vancouver (steam auxiliary), at Jordan River, Goldstream, in Victoria (steam auxiliary), and on the Saanich peninsula (steam auxiliary). Final units are in process of erection but when completed the total output will reach 128,000 h.p.

The illustrations and descriptive matters cover in a general way the complete operations of the company. The booklet was prepared by Mr. Frank Harris, manager of the British Columbia Electric Railway Company's publicity department, who is to be congratulated on the attractive way he has handled his subject.

Vernon

During the latter part of May the Municipal Electric Power plant at Vernon, B.C., commenced the supply of electric power during the day time from 7 a.m. till daylight the following morning. The inauguration of this day service will mean that the power plant on Davis creek will be running about twenty hours out of the twenty-four. Water is becoming sufficiently plentiful in the creek now to keep the plant in operation most of the time, and the electric light commissioners have decided to give a tryout to the plant to ascertain whether or not sufficient revenue can be had from electric power consumers in town to warrant the extra expense attached to the operating of the plant in day-time.

Several industries in Vernon have had motors installed for some time, which have been used for a short time daily, but with the turning on of the power for the all-day run many who are at present using other power will now turn to this more satisfactory motive force. Meters will probably be installed on the motors using power, and a lower rate per kilowatt hour than levied against electric light users will be charged.

New Wireless Station

The new wireless station which is to be located at Alert Bay, on the B. C. Coast, will be a full power station established to facilitate communication from vessels navigating the waterway between Vancouver Island and the mainland when between the Cape Lazo station, and the north end of Vancouver Island. Alert Bay is a busy settlement situated on Cormorant Island, and is a port of call for the northern coasting steamers. In addition to the establishment of the new wireless station at this point, the wireless service is to increase the power of the Pachena and Estevan stations on the west coast of Vancouver Island from two kilowatts to five kilowatts, and install the new type of apparatus known as the rotary disc type, which has recently been tried with great success at the Cape Lazo station. This will greatly increase the distance with which the two west coast stations can work, and it is considered that with good working conditions communication across the Pacific Ocean will be maintained.

Government Telegraph Service

According to a recent announcement by Mr. L. A. Palmer, superintendent of the government telegraph service for the Okanagan District, B.C., telegraphic communication between all the larger towns of the Okanagan Valley is now assured. The government has authorized the expenditure of considerable sums in the improvement and extension of the service between Penticton and Vernon, and operations will commence immediately. For the special advantage of fruit shippers, the government line has been connected with the C.P.R. freight depot at Okanagan Landing.

A Third Unit for Bonnington Falls

The West Kootenay Power & Light Company, who operate two plants on the Kootenay River at Upper and Lower Bonnington Falls, a few miles out from Nelson, will add to their No. 2 plant a unit of 8,000 h.p. capacity; this station already operates two units of 6,000 h.p. capacity

each, C. G. E. manufacture, which will bring the total at this point up to 20,000 h.p. While nothing definite has been announced it is understood that this extension is in connection with the electrification of parts of the Canadian Pacific Railway system in that neighborhood. The installation will be made under the supervision of Mr. L. A. Campbell, general manager of the West Kootenay company.

40,000 H.P. on Willow River

On the Willow River, seventeen miles from Fort George, B.C., is a water power capable of developing a minimum of 40,000 horse power. This power can be improved at a comparatively small cost. Plans for its immediate development are at present under consideration, and within a short time it is expected that Fort George will be supplied with power (including electric tram service if necessary) from this source.

Mr. W. T. Woodroffe, city electrician of Vancouver, has accepted the position of Street Railway Superintendent at Edmonton, with a fixed yearly salary plus a percentage of profits. There were a hundred applicants. Mr. Woodroffe has been in the City of Vancouver's employ since the middle of January last. Prior to that he was for twelve years connected with the B. C. Electric Railway Company as superintendent.

The committee appointed to consider the best method of lighting the town of Penticton, B.C., has recommended that tenders be called for the purchase of a 200 h.p. Deisel oil engine. This is a preliminary step towards a complete lighting system for this rapidly growing centre.

According to a recent announcement, the Prince Rupert Hydro-electric Company will erect a substation this summer at Porpoise Island, near the mouth of the Skeena river, for the supply of electrical power to the industrial plants to be located between Porpoise Harbor and Prince Rupert.

Montreal and Eastern Canada

The Electric Vehicle

"The Progress and Future of the Electrical Vehicle," was the title of a paper read by Mr. Day Baker, the New England manager of the General Vehicle Company, and the President of the Electric Vehicle Club of Boston, Mass., at a meeting of the Montreal Electrical Society, on June 14th. Mr. P. T. Davies presided, and mentioned that the membership was now over one hundred and fifty.

Mr. Baker sketched the early history of the electric vehicle, its progress during the past twenty-five years, and spoke of the great success that it has attained in the United States and foreign countries. He stated that in the past year his company has increased its sales over the previous year approximately one hundred per cent., and seventy per cent. of the business was in repeat orders; that is, orders received from people who had purchased one or more machines before, and whose satisfactory experience led them to buy more. Speaking in general of the increased use of electric vehicles, Mr. Baker said: "The investment in electric vehicles in the United States at the present time is \$30,000,000 in pleasure vehicles and \$10,000,000 in commercial vehicles. During 1911, \$10,000,000 worth of pleasure vehicles and \$2,500,000 worth of trucks were sold, an increase for the year of thirty-one per cent. One electric vehicle manufacturing company has 1,000 trucks operated by seventy customers,

showing there must be many people who like the electric trucks and keep on operating them. Two express companies are operating 356 vehicles and three breweries are operating 172, three bakeries 119, and three central stations 15. Many of these installations are from six to eleven years old. The electric vehicle has proved a great success on account of the simplicity and economy with which it can be operated, and because it is constructed along extremely practicable lines. I believe that the use of the electric vehicle, and in fact all kinds of automobiles, is going to increase very fast. When the conveniences of the electric vehicle become generally known they will be bought for pleasure and business, regardless of economy. People like to ride by electricity. Electricity for all uses is popular, and if the central stations will do their share toward helping the vehicle manufacturer popularize them further, I am sure we will have plenty of electric vehicles in use."

Several questions brought out further points in the use of electric machines. Mr. Baker stated that the 1,000 pound vehicle cost 4c. per kilowatt, average price, or about 50c. a day for current, while horse feed would average \$1 per day. The paper was illustrated by 100 slides showing the variety of uses to which electric vehicles are applied, and also exhibiting many of the earlier types. One of the slides contained a message from Mr. Edison to Mr. Baker commend-

ing the latter's efforts in assisting to bring about the day "when the electric vehicle in our cities will become more common than the horse." Two moving picture films of the parades of electric vehicles through the streets of Boston were also shown.

Electric Road to Granby

In connection with the extension of the Montreal & Southern Counties Railway, the company have placed an order with the Canadian Westinghouse Company for electrical equipment. This includes three 500 kw. rotaries, six-phase, 60 cycle, 900 r.p.m., 600 volts d.c.; one 400 kw. motor generator set, 720 revolutions, generator 600 volts, motor 2300 volts; the necessary transformers, and ten quadruple 50 h.p. motor car equipments, with multiple unit electric pneumatic control for operating cars.

The electors of the town of Granby have passed a by-law granting the company a franchise and exemption from taxes for twenty-five years. The company agree to have the line to Granby completed within a year. The line which the company is building from St. Lambert to Chambly is meanwhile progressing rapidly. The roadbed of the old Central Vermont line to St. Cesaire is being rebuilt and much strengthened, as the speed of the cars on the new line will be greater. The line now owned by the company from St. Cesaire to Granby is also being rebuilt.

Conduit Commission Will Call for Tenders

The Montreal Electrical Commission, appointed to prepare plans for conduits in which wires are to be laid underground, has proceeded with its work to the point of being practically ready for calling for tenders for the St. Catherine Street conduits; this street has been the first to be dealt with. Afterwards plans for the other main thoroughfares will be prepared, and finally the side streets will be taken in hand. Owing to the necessity of obtaining reliable data as to the number and position of the underground pipes of various companies, and the requirements of the corporations who will use the conduits, the plans have taken a long time to prepare. The impatience expressed by certain laymen being due to failure to appreciate the technical difficulties in the way of such an undertaking. The St. Catherine Street conduits will cost about \$200,000.

French Translation of Code

At the monthly meeting of the Electrical Association of the Province of Quebec, held in Montreal on June 12th, Mr. Clarence Thomson in the chair, the question of translating into French a bulletin of the Code of the Canadian Fire Underwriters' Association was discussed, and it was decided to leave the matter in the hands of a special committee. The resignation of the secretary, Mr. R. M. Lynch, was accepted, and the nomination of a successor was left with the executive. Mr. Sayer brought forward the subject of a picnic, and a committee was asked to consider the desirability of arranging an outing. Arising out of the subject, Mr. James Bennett suggested that the Association hold a convention, at which papers should be read and apparatus exhibited. The evening concluded with an informal concert.

Sitting in the city of Quebec on June 18, the Public Utilities Commission heard the petition of the Dorchester Electric Company requesting the right to erect poles and string wires in accordance with the contract with the city for street lighting, and also the removal of useless poles rendering no service in various city streets, the property of

the Quebec Railway, Light, Heat & Power Company and the former Jacques Cartier Power Company. The Commissioners decided that inasmuch as the Dorchester Electric Company had the permission of the city to erect poles, they could go on with this work.

As the result of a ballot for members of committees of the Montreal Electrical Society the following were elected—Traction, Mr. A. G. Farquharson; telephone and telegraph, Mr. J. Hadwin; power, Mr. W. H. Turner; construction, Mr. W. H. Winter; contracting, Mr. U. A. Leduc; commercial, Mr. H. L. Etienne; manufacturing, Mr. T. N. White.

It was stated at the annual meeting of the Montreal Light, Heat & Power Company that the company have concluded a contract with the Canadian Northern Railway for supplying power to be used in connection with the building of the Mount Royal tunnel and with the running of the cars when the line is finished.

Mr. H. E. Smith, comptroller of the Montreal Tramways Company, has been elected a director of the Efficiency Society of New York, an organization for promoting efficiency in commercial, financial and industrial enterprises of all kinds, including public service corporations.

The Montreal Electric and Manufacturing Company, Limited, Montreal, have decided to considerably enlarge their factory by erecting a fireproof addition to their present building.

Development of Water Power on the Meduxnakeag River at Woodstock, N.B.

The Meduxnakeag River flows through the town of Woodstock and joins the St. John at that place. For many years power has been developed at the mouth of the river supplying small industries on both sides of the river. About ten years ago H. A. Connell, one of the directors of the Woodstock Electric Company, purchased the water power and mills belonging to the Davis Estate on one side of the river. He then built an electric light station, equipping it with direct-current apparatus, making it a duplicate of the steam plant belonging to the company. For a number of years he sold the current to the Woodstock Electric Company.

In 1905 the Woodstock Electric Railway, Light & Power Company was organized and acquired a property two miles further up the river which had a good water power site which they began at once to develop. They built a dam, erected a power house, and strung lines to the town of Woodstock, where they acquired the property of the old company and H. A. Connell's water power privileges at the town and, afterwards, secured control of the water privileges on the opposite side of the river. They have a head of 32 feet equipped with two Jenckes water wheels of 300 h.p. each and two 200 h.p., three-phase generators with which they are supplying the town of Woodstock with electric current for light and power.

Diversion of Water from Great Lakes by Chicago

An important publication of some 280 pages, dealing with the proposed diversion of water from the St. Lawrence Drainage Basin, by the city of Chicago, has just been issued. The diversion vitally affects Canadian navigation and allied interests as well as the harbors, canals and other improvements to navigation on which Canada has expended vast sums of money.

CANADIAN TELEPHONES

For four days in Montreal and one day in Ottawa, the Railway Commissioners heard the application of the Montreal City Council for an order requiring the Bell Telephone Company to reduce the rental of business telephones from \$55 to \$50 and residence telephones from \$35 to \$30 as well as to abolish the mileage charge of \$5 per quarter mile in the case of distant subscribers, who are located within the corporate limits of the city of Montreal. The case for the Council was prepared by Messrs. Francis Dagger, of Toronto; J. C. Kelsey, of Chicago, and Fred R. Mott.

Summarized, the contention of the Council was that there was discrimination in the charges made to different parts of the city, that a flat rate would lead to greater development, and that the Council's demands meant that, on the present basis, the earnings of the company would be reduced by \$118,030 per annum. Mr. Butler, the City Attorney, analyzed the financial position of the company, pointing out that the surplus, according to the last balance sheet, was \$8,708,754. Of the 153,959 telephone stations in Canada, 70,000 were in Montreal and Toronto, and it was suggested that the two cities were paying for comparative losses made elsewhere. The company had filed an inventory showing a value of property of \$6,460,830 with an earning of 4.57 per cent. on the Montreal investment; exception was taken to this on the ground that a former statement showed \$4,480,913, and that the larger sum was merely an addition to book value, made for the purpose of inflation.

The chief witness for the city was Mr. Kelsey, who gave detailed evidence regarding charges, and made comparisons of the average earnings of United States Bell companies, with the object of showing that their earnings were lower than those of the Canadian company and that the latter was charging too much.

Many witnesses were called for the Bell Telephone Company, including Mr. E. S. Bloom, vice-president of the Missouri and Kansas Telephone Company, whose testimony was in general opposed to the idea that a just comparison could be made between Montreal and certain United States cities.

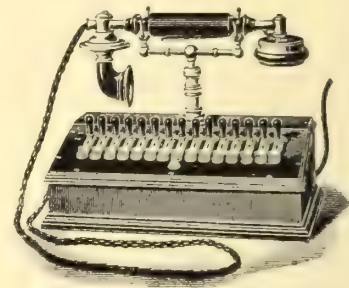
Mr. C. F. Sise, the general manager, dealt in detail with the charges of discrimination, and explained how these had arisen. His idea, in order to abolish the different charges, was to establish a metropolitan area and suburban zones. If the outlying wards to the north were taken in by instructions of the commission, Mr. Sise predicted that the company would have to raise the rates all over the city. If the rates were to be lowered, as suggested by the city, the reduction would entail an annual loss of \$115,720, or a reduction in net profits of from 4.51 per cent. to 2.72 per cent. on the company's total investment of more than six million dollars. "It has been our custom," he said, "to build up a reserve fund by occasional sales of stock to shareholders at one-fifth above par, but still at a good premium on the market price. As a result of this policy we are really under capitalized."

Other witnesses for the company were Mr. W. H. Winter, superintendent; Mr. E. Palm, auditor, and Mr. Powell, accountant.

During the hearing there was considerable discussion as to the replacement value of the company's Montreal Exchange plant, it being contended by the city that the estimate of the company was too high by \$220,000.

Montreal vs. Bell Telephone Company

The Sterling Telephone & Electric Company of London, England, makes a specialty of automatic telephones for inter-communication in homes, offices or factories up to a capacity of 30 units. It is generally understood that with all ordinary inter-communication telephones on the single line or common return system, induced overhearing and cross talk make themselves felt to a more or less marked degree; so much so that it has been difficult for two pairs of persons to engage in conversation simultaneously without confusion resulting. It is claimed by the Sterling company that they have introduced an entirely new system which in addition to possessing the advantages of a central battery, effectually overcomes the short-comings above referred to. They do not put this system forward as one which will provide a secret conversation service but they claim that cross talk has been so far eliminated that it is now possible with a system of (say) 30 of their interphones to carry on the maximum number of conversations simultaneously without confusion. This is accomplished, it is claimed, with only



two additional common wires in the cable. Another feature of considerable importance is that all local batteries are entirely dispensed with.

The cut shown herewith shows one of the desk types of automatic interphones installed by this firm. It is only necessary to use the line selected when making a call. The line of the person required is selected by pulling down one of the levers. The lever remains down until the conversation is finished, when the act of replacing the hand combination causes the lever to automatically assume normal position.

Telephones for Mines

A booklet descriptive of telephones and signalling apparatus for mines has been issued by the Northern Electric and Manufacturing Company, Limited, Montreal. Besides emphasizing the economies which result from the adoption of the telephone in mines and pointing out improvements in mine signalling sets, the booklet gives technical descriptions of the various appliances manufactured by the company and the advantages claimed for them.

Bell Building Extensions

Plans are almost completed for the extension to the Bell Telephone Company's building in London, Ontario, which will practically double its present capacity. Plans are also under way for a new building for the Bell Telephone Company at Orillia, Ontario, on the property recently purchased for that purpose. Tenders have been accepted for extensions to the Beach Exchange of the Bell Telephone Company at Toronto and work will be proceeded with at once.

Kellogg Construction Materials

The latest bulletin the Kellogg Switchboard and Supply Company have to offer the telephone trade, is the number 60, on construction material, tools and miscellaneous supplies. Every effort has been made to list, in this bulletin, the best materials, apparatus, etc., of proven merit, and in this way the customer may obtain what he needs with the assurance that he is not buying something of doubtful efficiency.

The book also serves as an aid and guide to good line construction, advising in its different chapters, the best way to handle different phases of telephone line construction. For instance, on page 34 we have: "List No. 126 insulated wire has a No. 18 B. & S. gauge copper conductor, rubber-insulated to a total diameter of 7/64 inches, over which is placed a heavy saturated weatherproof braid. This protects the rubber insulation from mechanical injury and also prevents its hardening from exposure to sun and wind. This grade of wire should be used for all outside wiring exposed to the weather, and the List No. 126 single conductor is usually the most convenient form for connecting open wires into cable boxes (when used for this purpose it is commonly called 'spider wire'). It is also most suitable for forming hand-made cables to bring 100 wires or less into small central offices where the open lines can be brought to a single 'junction hole' within fifty feet of the exchange building (when so used no box or arrester is needed on the pole)."

On another page under Batteries:—"One point we wish to impress on our customers in connection with dry batteries is the importance of not allowing them to become old and stale before being placed in service. Any battery starts to dry out and deteriorate the moment it is made and actual tests have determined that an absolutely fresh battery will give much longer life than will those that have remained in storage even a few months before being placed in service. This 'shelf deterioration,' as it has come to be called, has cost dry battery users thousands of dollars."

A discussion on ground rods opens with: "The importance of good ground rods on one wire 'grounded' lines is perhaps overlooked oftener than any other matter bearing on good service. Telephones frequently ring and talk poorly and are blamed for bad service that would wholly disappear if an adequate ground connection were provided."

Every exchange manager planning on the purchase of supplies for line construction should have this book for assistance and convenience in ordering. Illustrations are plentiful and the pages are printed with good, readable type.

Telephone Progress in B. C.

The B. C. Telephone Company have placed an order with the Canadian British Insulated Co. for a \$25,000 armored submarine 84 circuit cable which is to be laid between Vancouver and North Vancouver under Burrard Inlet. The cable is expected to be delivered in Vancouver in the course of the next two months. After its arrival in Vancouver two weeks will be required to lay the cable and connect it with the Vancouver system. In connection with its other extensions, construction work and improvements, the telephone company announce that work is progressing well on the new Highland exchange and that it will be opened on Sept. 1. The structure is up now to the roof. In the course of a few more days the interior work will be started.

The South Vancouver district is growing so rapidly that the company are considering the construction of a new exchange there. It is probable that in the course of the near future they will have an announcement to make as to whether or not the structure will be put up this year, or left as part of the programme for next season. The new

central energy system which is being placed in New Westminster will be ready for use on Sept. 1, supplanting the old magneto system now being used. An agreement has just been entered into between the telephone company and the city of New Westminster for the joint ownership of the telephone and light poles of that city. This agreement will cut the number of light and telephone poles necessary for the service in two, and will therefore obstruct the streets just so much less. Both light and telephone wires will be carried on the same poles.

Tungsten Lamp Rights

Hamilton, Canada, June 21, 1912

Editor Canadian Electrical News,
Toronto, Ont.

Dear Sir:—

In the last issue of your paper you published an advertisement over the name of a Toronto Electrical Manufacturing Company, to the effect that we were manufacturing under a license received from such company.

This advertisement is incorrect. We wish to state that we have no connection whatever with any company in Canada or the United States, but are an entirely independent factory and that our rights to manufacture Tungsten Lamps were obtained from the original patentee in Austria.

We trust that you will give this letter the same publicity that you did the previous advertisement.

Yours truly,

The Canadian Tungsten Lamp Co., Ltd.
W. H. Ginder, President.

New Books

"Modern Illumination" by Henry C. Horstmann and Victor H. Tousley; F. J. Drake & Co., publishers, Chicago. This book goes fully into the practical side of the science of electric lighting, bringing the subject up to date by explanations of the latest achievements and discoveries. It is a book that can be read with advantage by the layman, the workman, the student or the expert. It is an all round ready-reference book, complete and accurate, and of undoubted value to anyone who is interested in modern methods of electric lighting.

The Annual Financial Review

Houston's standard publications, 7 and 9 King street east, Toronto, have just issued their Annual Financial Review for 1912, which is a carefully revised summary of facts regarding securities listed on the Montreal and Toronto stock exchanges and of other prominent Canadian companies. It includes the current annual statements of companies; the highest and lowest prices of stocks and bonds on both exchanges for each month for ten years; the number of shares sold each month for the past fifteen months; rate of dividends paid for past years and other important items in the history of the different companies, such as increases in capital stock, particulars of franchises, when bonds are redeemable, dividends payable, together with a mass of other facts. This year it comprises 700 pages of solid information and inasmuch as the reports included have reference to a very large number of electrical operating companies, this review will prove extremely interesting to electrical men, whether or not they belong to any extent to the investing class.

The Nimkish Power & Development Company has been incorporated with head offices at Victoria, B.C.

ELECTRIC RAILWAYS

Heavy Service Electric Locomotives

Work is now well under way on a consignment of thirty-nine heavy-service, electric locomotives that are being built by the Baldwin-Westinghouse combination for the New York, New Haven & Hartford Railroad Company, for use on the latter company's lines between New York and New Haven. This is one of the largest consignments of electric locomotives that has ever been under construction and is of further interest in that the design adopted is considerably different from any heretofore used for electric engines and in that thirty-six of the engines are arranged for single-phase service only. While there are no decidedly new features involved, as all of the methods used have been heretofore employed, they have never before been utilized in the combination devised for these thirty-nine engines.

In their construction have been combined what have been shown in every-day road service to be the best features of the heavy locomotives built in the past. An eight-motor driving arrangement similar to that first used in the 069 New Haven Locomotive and an articulated running gear similar to that used for the 072 class locomotives have been adopted. Each engine is driven by four twin-motor units—eight motors in all—with one twin motor unit mounted over each driving axle. The arrangement may be seen in Fig. 1. This scheme has shown itself to be a very desirable one for the following reasons:

gear meshing with the pinion of each motor can be used in place of two gears necessary with a small motor of the same total capacity.

4. The use of single gear being possible because of the reason of item 3. the motor can be longer which permits of a more economical design.
5. Finally, eight motors actually cost less than do four having the same aggregate output.

In general design and arrangement all of the locomotives are the same, but three of them are for both alternating and direct-current operation in fast freight and heavy passenger service and are designed to handle a trailing load of 800 tons at a maximum speed of 45 miles per hour. When operating on single-phase alternating current they take energy at 11,000 volts and 25 cycles, and on direct current 650 volts. Thirty-six of the locomotives are equipped for 11,000 volt, 25 cycle, alternating-current operation only, are primarily for fast freight service, but will also sometimes haul passenger trains, and are designed to handle a trailing load of 1,500 tons at a maximum speed of thirty-five miles per hour. All thirty-six of the locomotives are designed to exert a maximum tractive force of 40,000 pounds.

The four pairs of driving wheels and two pairs of small leading wheels are in two groups, each having outside frames of the bar type. These cast steel frames are four inches wide and are similar to those used in steam loco-

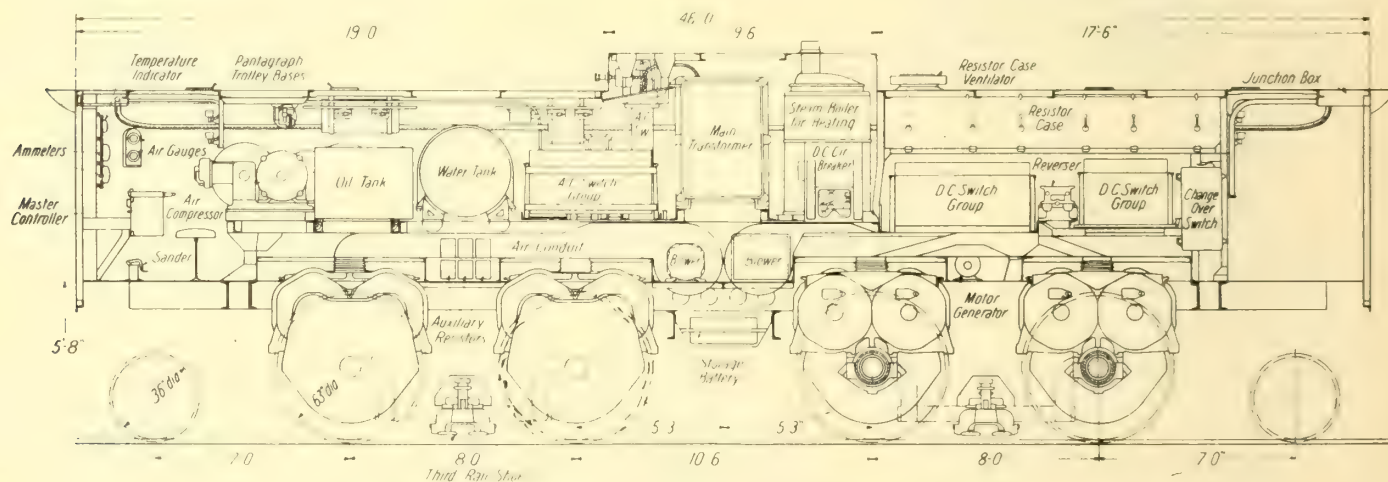


Fig. 1—Showing general design of 8-motor, heavy service, electric locomotive

1. Peripheral speed is a limiting feature in rail-motor design. With two small motors it is possible to use a rotative speed approximately twice that possible with one large motor. Each motor has therefore one-half the number of poles of practically the same size as would be required by one equivalent large motor. Therefore two of the small motors have practically the same number of parts such as field coils, armature coils, and brush holders as would be required by one large motor.
2. Each of the small motors has a diameter practically half of that of one equivalent large motor, hence a saving in weight and space results.
3. A further saving in weight results because each small motor exerts but one-half the torque that must be exerted by one equivalent large motor; therefore a single

otive practice. The pulling and buffing strains are transmitted entirely through the truck frames which are braced transversely at the end of the trucks and between the driving axles. The inside faces of the driving pedestals are finished to a taper and are fitted with adjustable wedges. The pedestal binders are cast steel. The drawbar pull is transmitted from truck to truck by means of a draw bar adjusted to leave a one-half inch maximum clearance between the end ties or bumper guides of the trucks when all the slack is pulled out. The truck cross ties or bumper guiders which are located on trucks at the mid-length of the locomotive, are equipped with spring buffers which assist in transmitting the buffing shocks from truck to truck. The drawbar has a slotted hole in one end. With this arrangement all pulling strains are transmitted through the drawbar and pushing and buffing shocks through the spring buffers and bumper girders.

Midway between the driving wheels, the bar frame of each truck is braced transversely by a built-up structure on which the truck centre pin is mounted. This pin carries no weight, its only function being to hold the truck in alignment with the cab. The centre-pin of one truck is allowed a limited longitudinal movement with reference to the car underframe to relieve the cab frame from pulling and buffing strains.

A two-wheeled truck of the Rushton type with outside journals is arranged under each end of the locomotives and carries the small guide wheels. The Rushton truck is of the radial type, its frame being connected to the main truck cross tie by two links which are so arranged in relation to one another that the intersection of their centre lines, if they were extended, would intersect on the centre line of the locomotive at the correct point for the truck radius-bar pin. This construction was adopted because the motors are so located that it is impossible to place the radius pin at its normal position on the centre line. A radial type draw bar, arranged to receive a housing for a Westinghouse friction draft gear is mounted on each end of the engine. Thrust springs are provided to limit the lateral movement of the draw bar. The coupler shank is supported by a carrier iron which is bolted to the end bumper casting. Each group of two pairs of driving wheels and a pair of truck wheels is equalized on each side of the locomotive. The springs are of the usual semi-elliptic form and are mounted directly over their respective boxes. Helical springs support the truck frames at their outer ends. The equalizing beams are of cast steel.

An underframe composed of two 12-inch, steel channel side sills and two trussed center sills support the cab and equipment. The cab covers the whole locomotive and is built of No. 14 steel plate on a Z-bar frame. The cab underframe is supported at four points, being at the inner ends of the truck, with their centers eighty-four inches apart transversely, while the other two are located, their centres thirty-four inches apart transversely, between the truck wheels and the adjacent driving wheels. As this arrangement is duplicated on both trucks, there are four points of support at mid-length placed wide apart transversely and two points near each end, placed comparatively close together. The weight of the cab is transferred to the truck frames through coiled springs, and the spring pocket plungers slide on the frame cross ties when the engine is traversing curves. Thus the cab floats on the trucks, being held in proper alignment with them by the centre pin.

Principal Dimensions

The principal dimensions of all thirty-six of the locomotives are as follows:—length between coupler faces, 50 ft.; width over all, 10 ft 3 in.; height to top of cab, 12 ft. 6 in.; height to top of clear storey, 13 ft. 10 in.; wheel-base, rigid, 8 feet 0 inches; wheel-base, total, 40 ft. 6 in.; driving wheels, diameter, outside, 63 inches; driving wheels, diameter, centres, 56 in.; driving journals, 7 in. x 13 in.; truck wheels, diameter, 36 in.; truck journals, 6 in. x 12 in.; weight on driving wheel, for a.c.-d.c. engine, 182,000 pounds; weight, total locomotive, for a.c.-d.c. engine, 240,000 pounds.

Eight No. 409 C, single-phase, commutator type, series motors, having a capacity of 170 h.p. on a one-hour rating drive each locomotive. The motors are grouped together in pairs. The two motors of each pair—a right hand and a left hand motor—are bolted together so as to form a unit. One pair of motors is mounted rigidly on the truck frame over each of the four driving axles. Each pair of motors is provided with two axle bearings which carry a quill which is concentric with and surrounds the axle. A single gear is secured on one end of the quill and into this gear mesh the two pinions keyed on the motor armature shafts.

Mechanical connection between the quills and the driving wheels is effected through helical springs which are mounted between the driver spokes and the projecting arms provided on each end of the quill. A radial clearance of $1\frac{1}{2}$ inch is provided between the inside of the quill and drive wheel axle so that the drivers are free to follow irregularities in tracks.

This method of mounting relieves the axles of the dead weight of the motors and insures that the operation of the locomotive will be easier on the tracks. The tops of the

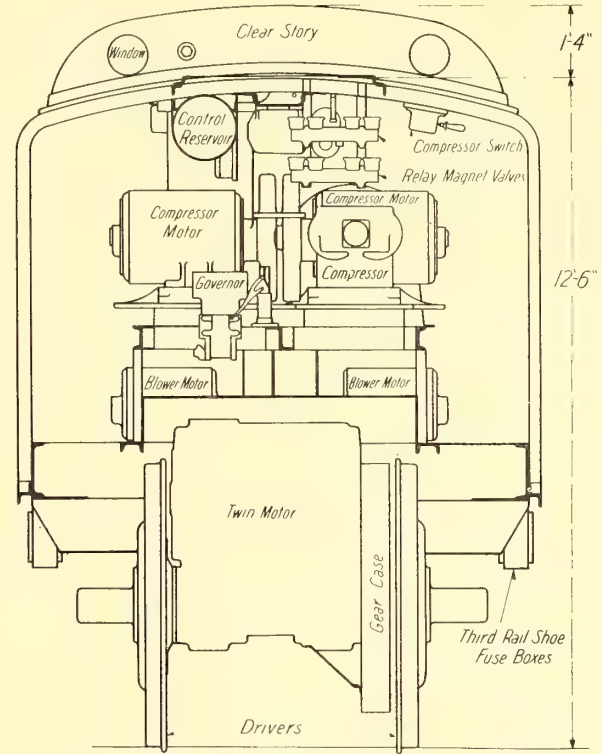


Fig. 2—Transverse section, 8-motor locomotive

motors extend into the cab about six inches above the floor line. A low deck is built over each pair of motors and doors are provided in the decks in such positions that free access to the commutators and armature bearings is afforded. Flexible leads of ample length to accommodate all movements of the motors relative to the cab extend through insulating bushings in the floor and electrically connect the motors with the control apparatus.

Of the thirty-nine locomotives three are arranged for operation on either alternating current or direct current and these are provided with control equipment that can be used in either service. Therefore the pneumatically-operated control switches work in combination with a transformer and preventive coils when the locomotive is receiving alternating current energy and in combination with grid resistors when it is receiving direct current. Each pair of motors is connected permanently in series.

In alternating-current operation the four pairs are connected in multiple and on direct current they may be connected two pairs in series or all four pairs in parallel. When operating on alternating current from the line at 11,000 volts the energy passes through an oil circuit breaker to the primary of a main transformer and thence to ground. A number of taps are provided on the secondary winding of this main transformer and are connected, through preventive coils, by means of the pneumatically-operated switches to the motor circuits. There are twelve voltage steps on the transformer winding, nine of which are for running points.

The pneumatic switches, used for operation on alternating current are assembled in one group. This group is located close to the transformer. Reversal of the direction of rotation of the motors is effected with two pneumatically-operated drum type reversers. Each reverser is so connected as to handle two pairs of motors. When the locomotives are on direct current the control of the motors is accomplished with two other groups of pneumatically-operated switches which connect the pairs in series and in parallel, in combination with the resistors. The switches and resistors used for operation on direct current are supported at the centre of one end of the locomotive. The switches are arranged in one straight line with the resistors directly above them so that the connecting leads between switches and resistors are of minimum length. Two master controllers, one located in each end of the cab, are provided. With these the operation of the pneumatically-operated switches and reverser and hence the motors can be regulated when a locomotive is running either on alternating current or direct current.

Two Sirocco type blowers, for handling cooling air, each driven by a small alternating-current—direct-current motor are located in the centre of the cab directly under the main transformer. These blowers draw their air outside of the locomotive and discharge it through the main trans-

former, motors and resistors. The equipment is thereby maintained at a moderate temperature even when operating under severe overloads. A double E. L. air brake equipment is provided on each locomotive. Two compressors, each having a capacity of 50 cu. ft. of free air, per minute are mounted within the cab to supply air for the brake and control apparatus. Brake shoes are applied to all of the driving wheels and separate pairs of cylinders are provided for each group of wheels. The brakes can be applied to one group with a hand wheel located in a cab so that a locomotive can be held while standing in the yards.

An oil-burning steam heater plant capable of supplying 800 pounds of steam per hour is installed in the three alternating-direct current locomotives for the heating of passenger trains.

For collecting the current there are two pneumatically operated pantagraph trolleys for use with an overhead wire, and four pneumatically-operated third rail shoes are provided for use in the direct-current zone. There is also a small overhead direct-current shoe-type collector for use at cross-overs. All of the collector devices are arranged so that they are under the control of the engineer at all times from either of the control positions in the locomotive cab.

Industrial Progress and Trade Notes

Trade Publication

Condulet Talk.—Series 2, No. 9, issued by the Canadian General Electric Company, descriptive of type N condulets.

Alphaduct.—Small pamphlet issued by the Canadian General Electric Company, descriptive of alphaduct flexible conduit tubing.

Thumswitch trouble finder.—Pamphlet issued by the McGill Manufacturing Company, Valparaiso, Indiana, describing the thumswitch trouble finder, portable guards, lock guards, reflectors, etc.

Dim-a-lite.—Pamphlet issued by the Canadian General Electric Company descriptive of a turn-down attachment for an incandescent lamp. The "dim-a-lite" is a portable attachment for dimming a single electric light. There are five changes, full, dim, low, night-light, and out. It is claimed that a very large saving in current results from the installation of this equipment.

Leaflet 2496, issued by the Westinghouse Electric and Manufacturing Company, describes their out-door type, oil-insulated, self-cooling transformers. These are of the same construction as those built for indoor service with the additional features necessary for installation outdoors. The leaflet describes the details of construction and shows several views of outdoor installations.

Adams-Bagnall Equipment.—Bulletin No. 14-1, descriptive of Hubbell attachments for pull sockets and bulletin No. 14-2 descriptive of Hubbell sockets with locking spring shade-holder attached to shell, conduit box receptacle with elongated cap and candelabra receptacles for candle fixtures. Also Adams-Bagnall data sheets G 1-22 and 23 describing, with illustrations, Abolites for condulets of various types.

Bulletin No. 24, "The Economy Steam Turbine for Belt Drive," has just been published by The Kerr Turbine Company, Wellsville, N.Y. This bulletin shows Belted Economy

Turbine installations which are effecting marked economies over apparatus previously used. 900 turbines in successful service up to May 1, 1912, aggregating 75,000 horse power, 75 building in shops aggregating 7,500 additional horse power.

Western Cities Buying British Equipment

The Siemens Bros. Dynamo Works have recently received an order for the following apparatus from the city of Edmonton:—one 2000 kw. 3600 r.p.m., 3-phase, 60-cycle, turbo-generator for direct coupling to a Willans & Robinson turbine; one 750 kw., 280 r.p.m., direct current, 500/575 volt, compound-wound generator with commutation poles for direct coupling to a Belliss & Morcom high-speed vertical engine, and one 425 h.p. 3-phase, 60-cycle, 450 r.p.m. slip-ring motor with short circuiting and brush lifting device. The 750 kw. generator will be fitted with Siemens split commutator where the commutator is made up in two sections. Electrically this arrangement is just the same but mechanically it is far stronger and has the particular advantage that, since the bars are only half the length they would be if made in one piece, the chances of distortion due to temperature increases or mechanical stresses set up in running, are avoided.

The same company have also received a repeat order from the city of Regina for a 400 kw., 550/600 volt, 450 r.p.m. direct current compound wound generator with commutation poles, to be direct-coupled to a Belliss & Morcom vertical high speed engine, the set being a duplicate of one which has been running for nearly a year.

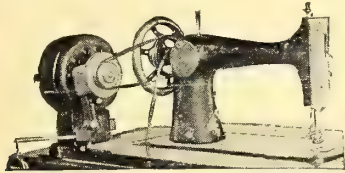
The city of Port Arthur has also placed a repeat order for a 500 kw., 450 r.p.m., motor-generator set similar to the one that has been running satisfactorily for over 18 months. The motor is of the synchronous type having an output of 750 B.h.p. on a 3-phase, 60-cycle, 2200 volt system. The generator has an output of 500 kw., at 550/600 volts, is compound wound and has commutation poles with Siemens two-

piece commutator. A two panel switchboard is also being supplied to control the above set.

The Winnipeg general hospital are also installing a 150 kw., 475 r.p.m., compound wound, direct current, 3-wire Siemens generator to be direct-coupled to a high speed vertical engine. The same company will also supply a switch panel for controlling the generator.

New Type of Sewing Machine Motor

A new and improved type of sewing machine motors is being manufactured by the Fidelity Electrical Company, Lancaster, Pa., which has been developed to make a self contained equipment which can be easily attached to the sewing machine and be economical in current consumption. This motor is made in two sizes for household and factory. It is stated that by actual test it will save one-third



of the current as consumed by any other make, due, in large measure, to the fact that the motor stops and starts automatically by means of a quick make and break switch, eliminating all waste current.

The speed of the sewing machine is increased or lessened by pressure of the foot on the treadle. At regular power rates it costs only $\frac{1}{4}$ c. per hour for electricity to operate it. The motors will fit any make of sewing machine with high or low arm. This equipment is adapted also for running watchmakers' lathes and other small machines where wide speed range is desired. For this work a reversing switch is installed so that motor and machine can be instantly reversed in rotation.

The J. M. Company Take New Quarters in Winnipeg

The Winnipeg branch of the H. W. Johns-Manville Company, dealers in asbestos, magnesia and electrical supplies, was moved into new quarters at 92 Arthur street, Winnipeg, early in June. The new building is a six-storey one with basement, 100 feet deep and 50 feet wide and will be occupied throughout by this company for offices and storerooms. As they will now have better accommodation, a larger and more complete stock of goods will be carried and a larger force will be employed to look after the company's interests.

Northern Electric & Manufacturing Co. Notes

M. S. Allen, formerly manager for the Western Electric Company at Omaha, has been appointed telephone sales manager of this company, with headquarters at Montreal.

E. H. McLea, chief engineer, and F. G. Donnelly, chief installer, have recently returned from an extended tour of inspection extending to the Pacific Coast. While in Victoria, B.C., they witnessed the cut-over of the new telephone central office, the equipment for which was both manufactured and installed by this company.

W. J. Doherty, supply sales manager, has returned from a trip to the seven district houses situated between Montreal and Vancouver.

H. W. Billing, district manager at Winnipeg, was a recent visitor in Montreal.

A. D. Smith, who has been spending a week in New York, where he attended the convention of Railway Telegraph Superintendents, has returned to Montreal.

The company has recently opened a branch office in the Tegler Building, Edmonton, Alta.

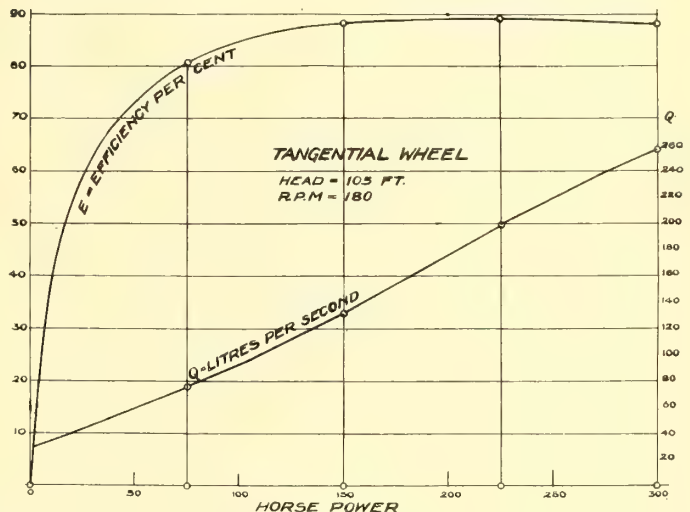
This company has recently bought property at Toronto, with the intention of putting up a two-storey and basement warehouse, to be occupied by their Toronto distributing house. Work on the building, which will contain approximately 30,000 square feet of floor space, will be started immediately.

Property has also been purchased at Calgary for the erection there of a building similar to that planned for Toronto. The new warehouse will contain about 20,000 square feet of floor space and will be centrally located.

At both Toronto and Calgary new quarters were necessary owing to the expanding business of the company and the lack of necessary accommodations in the buildings now leased.

High Efficiency Turbines

The accompanying curves show the efficiency operation of an Escher Wyss tangential wheel according to official tests recently made. This wheel is specially constructed for a head of 105 ft., normal 250 horse power capacity operating at 180 r.p.m. Similar curves were obtained showing equally remarkable efficiencies for an impulse turbine operating under an effective head of 3000 ft., having a capacity



of 6600 horse power when operating at 420 r.p.m.; and on a third turbine of 3500 horse power capacity, 500 r.p.m., under an effective head of 1900 ft. These turbines are all fitted with deflecting nozzle which eliminates the employment of any relief valve and at the same time keeps the rise in temperature very small. It will be noticed that in the curve shown the efficiency is over 80 per cent. from full load down to less than one-quarter and over 88 per cent. from full load to considerably less than one-half.

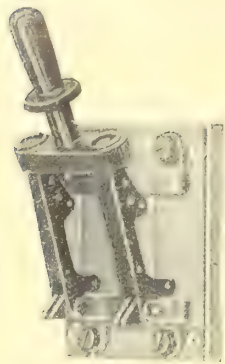
The Mainer Electric Co.

The Manitoba Gazette for June contains the announcement of a charter for The Mainer Electric Company, Limited, of Winnipeg, Manitoba. This company commences business with a capitalization of one hundred thousand dollars. They intend to represent several leading manufacturers of electrical materials and will stock in Winnipeg a complete line of electrical supplies, specialties and electrical appliances, also a special line of automobile and motor boat accessories. Mr. R. H. Mainer, for six years manager of the James Stuart Electric Company, is the moving spirit in this new enterprise and his long and close association with Western trade conditions should ensure the company a large measure of prosperity. The Mainer Electric Company, Limited, expect to have their representatives calling on the electrical and automobile trade throughout Manitoba, Saskatchewan and Alberta after July 1st.

The Power of Advertising

The Stromberg-Carlson Telephone Manufacturing Co. have issued an illustrated bulletin setting forth the power of advertising, written by Mr. H. C. Slein, manager of their sales and advertising department. This company is pursuing an extensive campaign of advertising, having in view the placing of the value of telephones before the rural communities who are not yet supplied with this modern service.

New Lever Type Main Switch



The Electrical Products Company of Canada are placing on the market early next month a Quick Break Lever Type Main Switch of original design. The principal features of the manufacture of this switch which should appeal to engineers and contractors are:—(1) The easy action, though governed by powerful spiral springs. (2) The absence of any possible chance of arcing. (3) The switch cannot be left in a half-off position. The metal parts are substantial and well finished, and

may be, if required, mounted on solid polished enamelled slate bases. These switches may be obtained from 20 amp. upwards and can be specially made up for switchboard work.

140,000 Volt Oil Switches

The Eastern Michigan Power Company have now in service on a 140,000 volt line a number of General Electric type oil switches, a brief description of which is given below. This apparatus passed a successful test of 465,000 volts.

The enormous electric stresses to which apparatus used on extra-high-voltage systems is subjected makes it imperative that such apparatus be most carefully designed and tested before being placed in service to insure against costly breakdown and interruptions.

This is particularly true as regards the oil switches depended upon to control and protect the transmission system, since they must not only be able to endure all stresses similar to those borne by the line insulators, transformers, etc., but in addition, those which are added by the necessity of breaking the circuit without undue disturbance under the various abnormal conditions which may arise, that is, they must have an added factor of safety.

These points were taken into full consideration in the design of the switches for the 140,000-volt line of the Eastern Michigan Power Company, the highest voltage line now in commercial operation. The oil switches passed a successful high-potential test of 465,000 volts.

They are, in general, similar to the 110,000-volt General Electric type F. form K-LO, tank-type switches in use in a number of large power plants in this and other countries and are hand operated. However, since it would be impossible to close switches of this size by hand with the ordinary operating mechanism, a newly developed tandem mechanism, in which the operation handle is moved through an angle of 180° is employed for this purpose. Some of the switches are automatic while others are non-automatic. The automatic switches are opened on overload by a series trip, which acts directly on the locking latch. Each switch consists of three single-pole elements, one in each phase, and in each element there is a double break of sufficient length for more than 140,000 volts.

Since the insulating bushings of high-voltage switches are apt to prove the limiting characteristic, a description of

them is doubtless interesting. They consist essentially of an entrance conductor surrounded by a semi-fluid compound contained in an insulating shell. The shell is built up of porcelain end pieces, a series of alternate non-carbonizing rings and treated barriers; the compound contains a number of insulating cylinders concentric with the conductor. The non-carbonizing rings and insulating compound have great dielectric strength. The barriers between rings are of large diameter and resist static surface discharge, thereby increasing the arc-over voltage. The concentric cylinders in the compound distribute potential strains on the interior of the bushing and increase the rupturing strength. The conductor which passes through the bushing serves also as a clamping bolt and holds together the integral parts of the bushing.

About midway between top and bottom of the bushing there is a flanged iron section which supports the bushing when set in the top of the switch tank and bolted to it. This construction enables the bushing to be easily removed for inspection. These switches have been in service for some time and are operating satisfactorily.

New Pass & Seymour Receptacle



The accompanying cut illustrates the P. & S. pull receptacle, No. 413, with Shurlok attachment and with Holophane reflector. The pull receptacle may be used as a concealed wall receptacle or in connection with outlet boxes. It may be used on 3, 3¼, or 4 in. boxes as two sets of holes for supporting screws are provided. It is supplied with 18 in. of pull chain. The Shurlok is unobtrusive and securely protects

not only the lamp but the reflector as well, since, when the lamp is locked in place, the reflector cannot be removed.

New Companies

The following companies have been registered in Montreal: The Cantelo Electric Company, the South Shore Power & Paper Company, and Fahr Bros. The latter will carry on the business of electrical supplies.

A special meeting of the shareholders of the Lake Erie & Northern Railway Company has been called for July 9th, in Brantford, for the purpose of confirming by-laws authorizing the issue of \$1,100,000 first mortgage bonds and \$500,000 second mortgage bonds. A large number of towns along the route the railway will serve, are voting to take parcels of these bonds.

Legal sanction has been given in Montreal to the rule of the Tramways Company that transfers are only available at junction points. Mr. Justice Monet, in giving judgment in an action for \$50 damages by Mr. W. Parker, Toronto, against the company, held that a conductor who had forcibly ejected a passenger following upon a dispute over a transfer acted within his rights.

Current News and Notes

Berlin, Ont.

President W. H. Breithaupt, of the Berlin & Northern Railway Co., has asked council to contribute \$6,000 towards the cost of a new bridge which is to be constructed across the Grand River at Bloomingdale. A by-law will be submitted to the ratepayers.

Brandon, Man.

On June 13th the street railway by-law authorizing the expenditure of \$300,000 for the immediate construction of some ten miles of street car lines was almost unanimously passed, the vote standing 716 for—44 against.

Burford, Ont.

The Electric Light Co., Burford, have purchased a new dynamo and will make important additions to the lighting system.

Collingwood, Ont.

A by-law will be submitted on July 3rd asking authority to issue debentures to the amount of \$30,000 for an electric power and light distribution system.

Caledonia, Ont.

The Hydro-electric Power by-law was passed by the ratepayers.

Calgary, Alta.

Tenders have been received for an additional 500 kw. synchronous motor-generator.

Drummondville, Que.

A disastrous fire occurred in the electric power house here on the morning of June 17th.

Edson, Alta.

On June 22nd a by-law was carried authorizing the issue of debentures to the amount of \$45,000 for the purpose of providing, constructing and maintaining an electric light and power system. It has also been announced that a telephone system will probably be installed here this summer. It is understood the government promises to do this if fifty subscribers can be obtained and thirty are said to have already signed contracts.

Fredericton, N.B.

Investigations are under way looking to the commencement of the development work which the St. John River Hydro-electric Company proposes to undertake at Hawkshaw on the St. John River.

A proposition made to the city by the Eel River Light, Heat & Power Company is under consideration by the council. The city engineer has been making an estimate of the amount of power the city could likely use.

Fort Frances, Ont.

Negotiations are under way looking to the construction of a hydro-electric plant at the White Horse Rapids, about 20 miles north of this town. The hydro-electric power commission of Ontario will probably undertake the work. It is said that a maximum of 10,000 h.p. will be available.

Fort William, Ont.

The Joint Board of Commissioners have decided that street cars must stop at every corner in both cities. This is in direct opposition to the recommenda-

tion of manager Robinson, who pointed out that the service would necessarily be much slower under the new arrangement.

Guelph, Ont.

The Radial Railway Company are placing an order for a snow sweeper to be ready for the coming winter season.

Galt, Ont.

A by-law will be submitted asking authority to purchase \$25,000 worth of second mortgage bonds of the new road which will run from Port Dover to Galt and to be built by the Lake Erie and Northern Railway Company.

A by-law will be submitted providing for the issue of debentures to the amount of \$45,000 for extensions to the hydro-electric plant.

Halifax, N.S.

City electrician P. R. Colpitt will require a large amount of electrical supplies for lighting system extensions.

Tenders were received up to June 19th by the Halifax Electric Tramway Company for the erection of a reinforced concrete car barn.

Hamilton, Ont.

The annual picnic of the Canadian Tungsten Lamp Co., of Hamilton, was held this year at Niagara Falls on June 22nd, when a large programme of varied sports was successfully carried out. The picnic was well attended and enjoyed by all.

Mr. A. L. Woolf, the Winnipeg manager of the Canadian Tungsten Lamp Co., was in Hamilton and Montreal recently and succeeded in closing a couple of very nice contracts for western delivery.

Mr. J. W. Moncur, the Montreal manager of the Canadian Tungsten Lamp Co., has just returned from a trip to Quebec and reports business in the ancient capital as being exceptionally brisk for this time of the year.

Kenora, Ont.

The standards for the new lighting system here have arrived and work has commenced putting them in position. The standards will carry five units and be placed approximately 85 feet apart. In all about 70 standards will be installed this year with more to follow next year.

Kamloops, B.C.

Contract has been awarded to Hutchinson Bros., Victoria, for the supply of five-light standards.

The magneto system which up to the present time has been used by the B. C. Telephone Company, has now been replaced by a central energy system, installed in a new building on Third avenue. The capacity of the switchboards installed is about 1,000 telephones, though the plant can be readily extended to a 2,500 capacity. At present 400 telephones are in use.

Lethbridge, Alta.

Superintendent Reid's report for the four months ending April 30 shows that the electrical department has yielded a clear profit of about \$7,000. Mr. Reid suggests that in view of the satisfactory

financial showing a reduction in power rates might be given varying from six cents down to two cents per kw.h. and flat rates varying from \$30 to \$25 per h.p. all subject to 10 per cent. discount. The report states that the street railway construction is advancing satisfactorily, though some delay has been occasioned by lack of material.

London, Ont.

Chancellor Boyd has fined the London & Lake Erie Railroad and Transportation Company \$1,200 and costs for operating cars on Sunday.

Meaford, Ont.

A by-law will be submitted on July 9th authorizing the town to enter into an agreement with the Georgian Bay Milling and Power Company for the supply of electric light for the town.

Moncton, N.B.

The Moncton Tramways, Electricity & Gas Company have received permission to extend their John street line an approximate distance of 300 yards to the I. C. R. shops. This extension will be installed immediately.

Montreal, Que.

Plans are being prepared for a fire-proof extension to the plant of the Northern Electric & Mfg. Co.

The Board of Control has prepared a report suggesting a change in the M. S. R. by-law regulations by which this company would be allowed to transport freight for city purposes.

Moose Jaw, Sask.

The city of Moose Jaw, J. D. Peters, Electric Superintendent, will receive tenders until August 1st for one 500 kw. steam driven generating set.

The gross earnings of the Street Car Company, which started operation on September 4, 1911, have increased from \$1,667 to \$5,192 per month or from a daily average of \$67 to \$192. In the same period, the average daily number of passengers carried has increased from 1,464 to 4,325.

North Toronto, Ont.

A by-law will be submitted to the ratepayers on July 6th authorizing an agreement between the town and the Toronto and York Radial Railway Co.

Niagara Falls, Ont.

The Niagara Falls Power Company have been given permission to issue bonds or stock to the amount of \$3,500,000, the money so raised to be used chiefly in completing the plant of the Canadian Niagara Power Company.

Nelson, B.C.

The proposal of the town council to take over the stock of the street railway shareholders at par and pay for it in twenty equal annual instalments without interest, will be accepted by the shareholders on condition that three per cent. be allowed on deferred payments.

The directors of the West Kootenay Power and Light Company have authorized Manager L. A. Campbell to extend the No. 2 plant at Bonnington Falls, so as to take care of an additional load, in anticipation of the electrification of the Canadian Pacific Railway from Castlegar

to Rossland. In the No. 2 plant there are already two units of 6,600 horse-power each, and the additional unit to be installed will probably be of 8,000 horse-power capacity, which will make the total horse-power available, when the last proposed addition is in place, 21,200. When the plant was built arrangements were made for two additional units to the ones above mentioned so that all that is necessary is the installation of the turbines and generators. The electrical equipment already installed is chiefly C. G. E. manufacture.

Ottawa, Ont.

The report of the board of arbitration, recently appointed to settle the wage dispute between the Ottawa Electric Railway Company and its employees, granted first and second year men an increase of 1½c. an hour and third year men and those of longer employ 2c. an hour. The maximum now is 25c an hour for weekdays and 27c for Sundays. The demand of the men was for 30c and 32c respectively. The agreement does not grant a nine-hour day nor recognize the union.

Port Colborne, Ont.

It is stated by the general manager of the Niagara, Welland and Lake Erie Railroad, Mr. C. J. Laughlin, that his company will immediately commence the construction of a line along the east side of the Welland Canal connecting Welland with this town.

Port Arthur, Ont.

The City Engineer has been instructed to prepare a report on a belt line street railway route to serve the outlying sections of the city.

Paris, Ont.

A by-law will be voted on to purchase \$25,000 worth of second mortgage bonds of the Lake Erie & Northern Railway project.

Quebec, Que.

The Stadacona Hydraulic Company will develop water power at Seven Falls at which point there is a 400-foot head. 10,000 h.p. will be developed initially and power will be disposed of to large consumers only, including the Quebec Railway, Light, Heat & Power Co. and the Bayliss Pulp & Paper Company.

Regina, Sask.

The following rural telephone companies were incorporated during May:—The Fish Creek, Beaver Creek, Ardath, Pangman, Beverley, Golden West and McLean Rural Telephone Companies.

Ridgetown, Ont.

The town council have purchased the lighting plant of J. H. McMackon, and it is said extensions will be made to both the plant and lighting system.

St. Mary's, Ont.

The ratepayers recently defeated a by-law to abolish the water, light and heat commission which is composed of three men.

Sorel, Que.

The town council contemplates the purchase of two new electric motors and three piston pumps.

Stratford, Ont.

F. C. Whatmough, electrical contractor, Stratford, Ont., has been awarded the contract to install an electric conduit system in proposed new building of the Canadian Bank of Commerce; also

an Auto signal system for the Auto Signal Company, Shelby, Ohio, in the factory of the Geo. McLagan Furniture Company; also an electric engine signal for the same company.

Summerland, B.C.

This town will soon need to renovate and enlarge their electric generating plant. They are considering at the present time the relative advantages of a hydro-electric plant or one operating by steam or crude oil.

Saskatoon, Sask.

It has been almost definitely decided to retain the routes originally mapped out for the street car line.

The new automatic telephone exchange has been placed in commission. At present there are 800 telephones on the line but the capacity is over 1,500 and it is believed this number will soon be installed.

A by-law authorizing expenditure of half a million dollars on a municipal street railway system carried almost unanimously—only one vote contrary.

Toronto, Ont.

The city's share of Toronto Railway receipts for the month of May amounted to about \$90,000, or almost \$3,000 per day. This is considerably more than double the receipts of five years ago.

The Board of Control are making application to the Dominion Railway Board to have all overhead wires in the down-town district placed under ground. The matter is also being taken up with the Dominion Government with a view to reaching an arrangement with the electrical companies operating here to bear their share of the expense.

The Board of Control has given instructions to Works Commissioner Harris to prepare an estimate of the cost of equipping with rolling stock, etc., the lines of railway now under construction by the city. The fear is expressed that the Toronto Railway Company might not be ready to operate these lines for some time.

Latest advices in the street railway situation are that although negotiations between the directors of the Street Railway Company and the men's representatives have come to a standstill, there is every indication that an amicable settlement of the differences between the parties is in sight.

Truro, N.S.

The town council has been endeavoring since January 1st to make an agreement with the Chambers Electric Light Company but without success. The matter has now been handed over to the Public Utilities Commission for adjustment.

Vancouver, B.C.

The B. C. E. R. Co. has placed a sample order for a low-step centre entrance car.

H. Birks & Sons, Ltd. require equipment for a \$450,000 office building on Granville and Georgia streets.

Winona, Ont.

Smith, Kerry & Chace have called for tenders for a turbine pumping unit.

Welland, Ont.

It is estimated that a municipal transforming and distribution system could be installed for \$45,000 so that power could be purchased from the Hydro-electric Commission. It is probable a by-law will be submitted.

It is probable a by-law will be submitted.

Winnipeg, Man.

Tenders will be received until July 17th for motors, switching apparatus and accessories for high pressure plant.

Tenders will be received until July 2nd for 60,000 lbs. No. 8 and 20,000 lbs. No. 6 weatherproof copper wire for city purposes.

Canada Sales Co., Donalda Block, Winnipeg, have been awarded the contract to supply 50,000 lbs. No. 6 stranded bare copper cable for 13,000 volt power line to Bird's Hill Gravel Pit.

Walkerville, Ont.

A new company has been organized to manufacture electric vehicles both of the pleasure and commercial type. It is called the Baker Motor Vehicle Co., Ltd., and will control the sole Canadian rights for the well-known Baker electric. It is likely a factory will be built in Walkerville. Mr. Hiram H. Walker is president of the company.

Hamilton Personals

Mr. William H. Marsh, who for the past ten years has been connected with the Standard Underground Cable Co., of Pittsburg, Pa., in the capacity of Superintendent of Construction, has been appointed Secretary and Assistant Treasurer and Sales Manager of the Standard Underground Cable Co. of Canada, Ltd., with headquarters at Hamilton, Ont.

Mr. H. G. Burd, who for some time has been connected with the Standard Underground Cable Co., as sales engineer in the New York office, has been appointed assistant to the sales manager of the Standard Underground Cable Co. of Canada, Ltd., with headquarters at Hamilton, Ont.

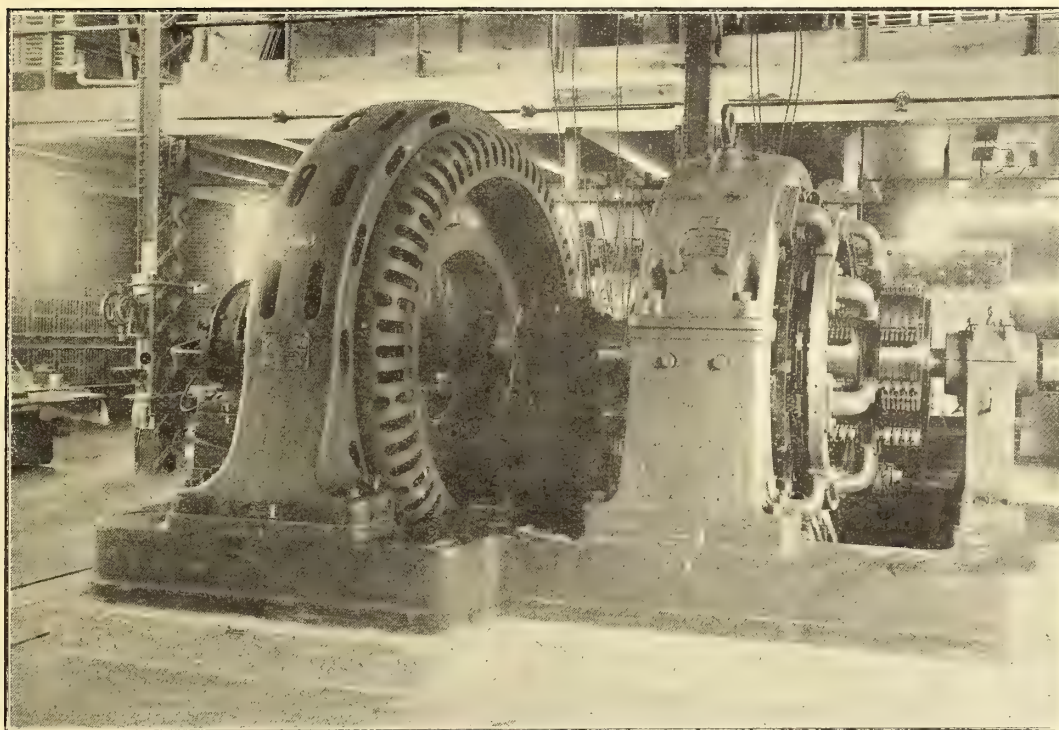
Moonlight Schedule for July, 1912

Courtesy of the National Carbon Company, Cleveland, Ohio.

Date.	Light.	Date.	Extinguish.	No. of Hours
July 1	8 00	July 1	11 00	3 00
2	8 00	2	11 30	3 30
3	8 00	3	11 50	3 50
4	8 00	4	0 10	4 10
5	8 00	5	0 30	4 30
6	8 00	6	1 00	5 00
7	8 00	7	1 20	5 20
8	8 00	8	1 40	5 40
9	8 00	9	2 10	6 10
10	8 00	10	2 40	6 40
11	8 00	11	3 30	7 30
12	8 00	12	4 00	8 00
13	8 00	13	4 00	8 00
14	8 00	14	4 00	8 00
15	8 00	15	4 00	8 00
16	8 00	16	4 00	8 00
17	7 50	17	4 00	8 10
18	7 50	18	4 00	8 10
19	7 50	19	4 00	8 10
20	7 50	20	4 00	8 10
21	7 50	21	4 00	8 10
22	10 30	22	4 00	5 30
23	11 00	23	4 00	5 00
24	11 40	24	4 00	4 20
25	0 30	25	4 00	3 30
26	1 30	26	4 00	2 30
27	No Light	27	No Light	
28	No Light	28	No Light	
29	No Light	29	No Light	
30	7 40	30	10 00	2 20
31	7 40	31	10 20	2 40

Total.....162 00

SIEMENS



Siemens 500 K.W., 450 R.P.M., 550-600 Volt Street Railway Motor Generator, with synchronous motor, supplied and installed for the City of Port Arthur

The above set has been running satisfactorily since August 1911. A repeat order has just been obtained for a duplicate set, from the City of Port Arthur. Attention is especially drawn to Siemens two piece commutator shown above. This type of construction has been standard with us for a number of years and used when the length of commutator exceeds about 11'. The two sections are on the same bolts and connected by lugs so arranged as to form veins and produce a current of air to pass between the two sections. The commutator is the same electrically but mechanically it is far stronger and in addition the following advantages are obtained: **Thorough Ventilation. Cool Running Assured. Short Commutator Bars Used. Distortion Due to Temperature or Mechanical Stresses Avoided. Surface Always in Good Condition. Brush Spindles Supported from Middle of Short Rigid Support.**

We have also supplied for the City of Port Arthur: 7-750 K.V.A. 22,000/2,200 Volt Transformers, 1-16 Panel, 22,000/2,200/550 Volt Switchboard, 1-Set 22,000/2,200 Volt Lightning Protection. Three of the above transformers were a repeat order after the first bank had been in successful operation for several months.

Siemens Brothers Dynamo Works Limited

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St. Petersburg

Vienna

New York

Head Office for Canada

10 Adelaide Street East, TORONTO

Branch Office: 707 McArthur Building, WINNIPEG

Condensed Department

RATE

Positions Wanted } 2 cents a word per inser-
Positions Vacant } tion.
Miscellaneous.

Tender advertisements, equipment for sale, etc., 15 cents per agate line (14 agate lines make one inch) per insertion.

Advertisers who wish to conceal their identity may do so by using an Electrical News box number without extra charge.

Forms close on the 18th of each month.

Situations Vacant

Wanted

A sales engineer for manufacturing concern. Apply Box 514, Electrical News, Toronto, Ont. 7

Opportunity

With the great protection of duty afforded Canadian manufacturers of electrical goods, coupled with the fact that there are practically no switchboards or panel boards made in Canada, most of this material now being imported, we are in position to offer a wide-awake man the chance of a life time. We are electrical contractors in the States, and have also carried on the manufacturing of panel boards, metering boards and cabinets, but owing to the conflicting nature of the two, we have decided to abandon the manufacturing business. We, therefore, offer for sale our entire plant, consisting of machinery, dies, tools, copper, slate, raw, semi-finished and finished material, templates, cost records, drawings, cuts for catalogues, etc. We will dispose of this as a whole at a sacrifice and on a cash basis.

Apply Box 505, Electrical News, Toronto, Ont. 68

Situations Wanted

Position wanted by electrician with over ten years' experience in practical and technical work. A.C. and D.C. operation, construction, repairs, high and low tension system. Desires to hear from power companies in need of a good man. Reply Box 503, Electrical News, Toronto Ont. 7

For Sale

Ayr electric light plant in first class condition, steam power, good service and contracts. Exclusive franchise in town of 1,200. A splendid chance for a practical man. Being sold because of owner's death. Apply D. M. Clark, 15 McKenzie Crescent, Toronto, Ont. 2-7F

CITY OF MOOSE JAW, SASKATCHEWAN

Tenders for Steam-Electric Machinery

Sealed tenders, marked "Tenders for Steam-Electric Machinery," addressed to the City Commissioners, Moose Jaw, Saskatchewan, will be received up to 12 o'clock noon of Thursday, August 1st, 1912, for the supply and delivery F.O.B. Moose Jaw, of one 500 kw. steam driven generating set.

Specifications and all information may be obtained upon application to J. D. Peters, Electrical Superintendent, Moose Jaw, or The Commercial Intelligence Branch, Board of Trade, 73 Basinghall street, London, England.

The lowest or any tender not necessarily accepted.

A. W. MAYBERY,

L. W. RUNDLETT,

W. F. HEAL,

City Commissioners.
Moose Jaw, Sask., June 21, 1912. 7

Town of Battleford

(Saskatchewan)

Sealed tenders will be received by J. P. Marshall, Secretary-Treasurer of the Town of Battleford, Saskatchewan, until noon on July 10th, 1912, for the supply and delivery of the following machinery and materials and for the performance of certain works:

Tender "A"—For the supply, delivery and erection of two generators, exciters, and switch-board.

Tender "B"—For the supply, delivery and erection of pumps and motors.

Tender "C"—For the erection of power house and construction of reservoir.

Tender "D"—For the erection of sewage disposal works.

Tender "E"—For the supply and delivery of approximately 4,725 ft. of 8-in. steel water pipe and specials.

Tender "F"—Trenching and laying steel water pipe, setting valves, etc.

Tender "G"—For the supply and delivery of two pneumatic storage tanks.

Plans and specifications may be seen at the office of the "Canadian Engineer," Winnipeg, Toronto and Montreal, at the office of the Battleford Town Engineer and Electrical Engineer and at the Consulting Engineer's office, Bottomley Block, Saskatoon.

A marked cheque for five per cent. of the amount of the tender must accompany each bid.

The lowest or any tender not necessarily accepted.

J. P. MARSHALL, Sec.-Treasurer,
Battleford, Sask.

McARTHUR, MURPHY & UNDERWOOD,
Consulting Engineers,
Saskatoon, Sask.

The Mainer Electric Company Limited of Winnipeg, Man.,

announce the opening up of a new Independent Electrical Supply House to carry on business throughout Manitoba, Alberta and Saskatchewan. Mr. R. H. Mainer, (late General Manager of the James Stuart Electric Company) is the head of this new organization.

A new and up-to-date stock of Electrical Supplies, Specialties and Appliances is being received as fast as possible, and representatives will be calling on the trade immediately after July 1st. YOUR BUSINESS IS SOLICITED.

The Company is still open to represent manufacturers on some standard lines and shall be pleased to give selling propositions very careful attention.

The Mainer Electric Company, Limited

Electrical Jobbers and Factory Agents.

Temporary Office, 302 Donalda Block, WINNIPEG, MANITOBA

Warehouse Space to Let to Factories Wishing to Place Materials in Winnipeg Stock.

New WESTON INSTRUMENTS

A Full Line of Alternating Current Switchboard Indicating Instruments

is offered by this Company, comprising:

WATTMETERS, Single and Polyphase.

POWER FACTOR METERS.

SYNCHROSCOPES.

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AMMETERS.

and New Models of Weston D.C. Instruments to match

This whole group of instruments embodies the results of several years exhaustive study and scientific investigation of all the complex electrical and mechanical problems involved in the development of durable, reliable, sensitive and accurate instruments for use on alternating current circuits.

Every detail of each of these instruments has been most carefully studied and worked out so as to be sure that each shall fully meet the most exacting requirements of the service for which it is intended. Neither pains nor expense has been spared in the effort to produce instruments having the longest possible life, the best possible scale characteristics, combined with great accuracy under the most violent load fluctuations and also under the many other trying conditions met with in practical work. Every part of each instrument is made strictly to gauge and the design and workmanship and finish is of the highest order of excellence.

We invite the most critical examination of every detail of each member of the group. We also solicit the fullest investigation of the many other novel features and very valuable operative characteristics of these new instruments and request a careful comparison in all these respects with any other make of instrument intended for like service. We offer them as a valuable and permanent contribution to the art of electrical measurement. Their performance in service, will be found to justify the claim that no other makes of instruments approach them in fitness for the service required from A.C. Switchboard indicating instruments.

Full particulars of design, construction, prices etc., are given in Catalogue E. N. 16. Write for it.

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Detroit, 44 Buhl Block.

St. Louis, 975 Olive St.
Denver, 231—15th St.
San Francisco, 682 Mission St.
New Haven, 29 College St.
Cleveland, 1522 Prospect Ave.

Paris, 12 Rue St. Georges.
Berlin, Genest St. 5 Schoenberg.
Mexico, 2, a Capuchinas 40.
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Limited

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We beg to advise our Customers that we are NOT working under License from ANY CANADIAN or AMERICAN Company.

We are prepared to fully protect our Customers, our rights being obtained DIRECT FROM THE ORIGINAL INVENTORS and PATENTEES in AUSTRIA.

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Winnipeg, Man.—56 Albert St., A. L. Woolf, Mgr. Toronto—342 Yonge St.
AGENCIES: New Brunswick—St. John, T. McAvity & Sons, Ltd.
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Are absolutely essential where you
have heavy work to do. We
carry a complete stock
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OSCILLATING BASE
which permits of a Stationary
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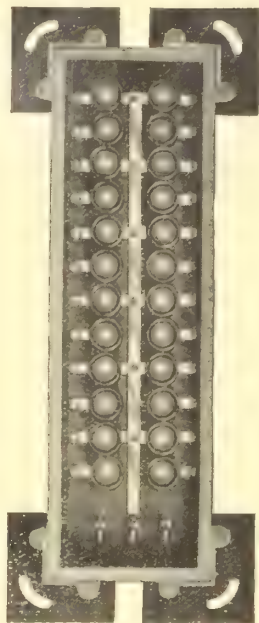
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This New Iron Will Stimulate Large Sales

Your sales of

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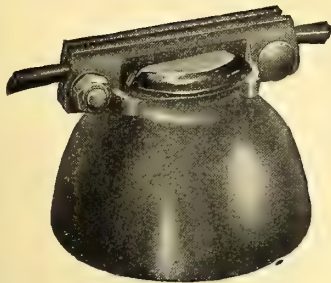
will receive an added impetus if you offer **this New Iron**. It is certainly the most perfect model that has ever been produced. All the old drawbacks of earlier models have been overcome. It consumes 20% less energy at a given heat than any other Iron on the market. It will **never** burn out. Rated voltage 110 v. tested for 20 minutes at 220 v. The most serviceable and economical electrical appliance ever made.

The new electric 3 heat disc stove is most carefully constructed to give the greatest heat at the smallest working cost. It is strongly made and beautifully finished, it will never break or burn out.

Royce Electrical Economic Heating Appliances are luxuries within the reach of **all**—the busy hostess, college girl, maid or bachelor. The time, money and trouble they save, the dirt and danger they do away with will make them the most popular Heating Appliances for your season's trade.

Royce & Co., Manufacturers, West Toronto, Ont.

Write to-day for illustrated catalog and Agency terms.

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Clamps, Insulators,
Twist Splice
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The Chicago (U.S. and Canadian Patents) Conduit Rod Coupling

Best answers
the purpose
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Used
by leading
Lighting, Trac-
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Companies in the
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This coupling makes a joint that is a
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Write for descriptive folder and prices.

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150 Select Designs

**Large Stock
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"The high-tension wiring consists of 1" copper tubing and the low-tension busbar of copper bars 3" x 1/4". All the connections between cables, disconnecting switches, oil switches and low-tension busbars, also between disconnecting switches, oil switches and high-tension busbars are made with

Dossert Connectors

"These connectors form a mechanical connection without soldering. They save considerable labor and time in the erection of the apparatus and afford easy facilities for disconnecting circuits in case of trouble or when temporary connections are required."

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Excello Lamp
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Splicing Clamps. Made of high-grade tool steel. The spring temper in the handles obviates the danger of their bending, and this insures a perfect joint.



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STEEL — (Not Cast Iron)

Are the most Modern Fittings for Exposed Conduit Work

ONCE TRIED - ALWAYS USED

Because they are much lighter and stronger and at the same time giving more room in the box to do the work than is found in cast iron boxes. They are also very neat in appearance and are now used by the most exacting contractors throughout the land because they make the job.

Made in all types and sizes from ½" to 1½"



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No. 6



No. 1



No. 2



No. 5L



Metal Nipple Cover



Blank Metal Cover



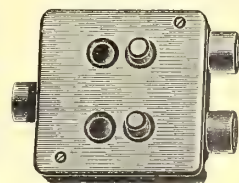
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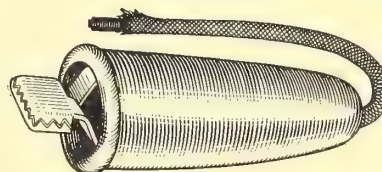
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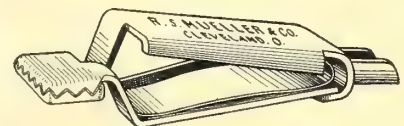


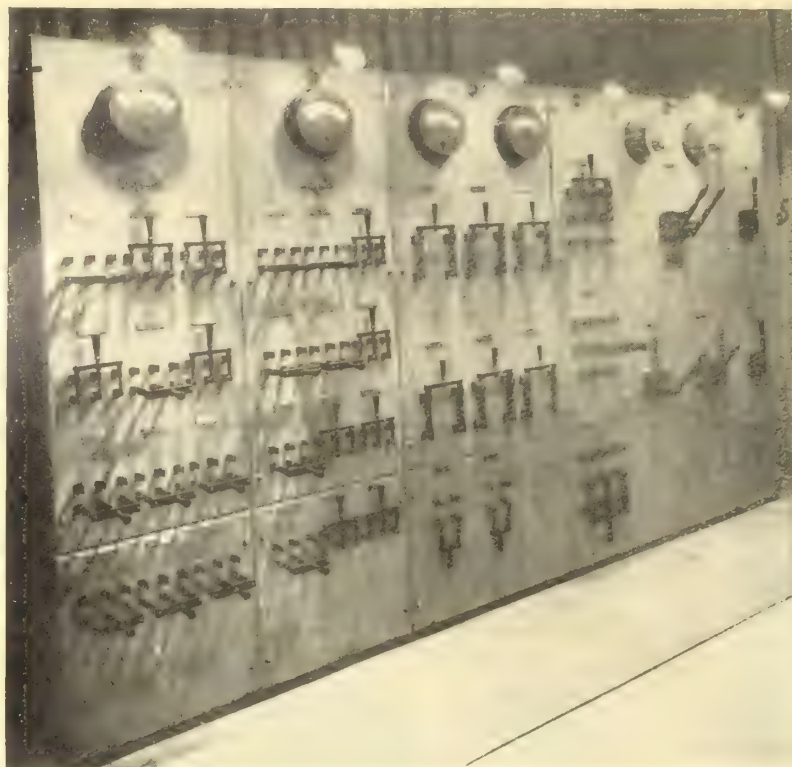
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Are the make used in many of the largest institutions, office and government buildings in the United States and Canada.

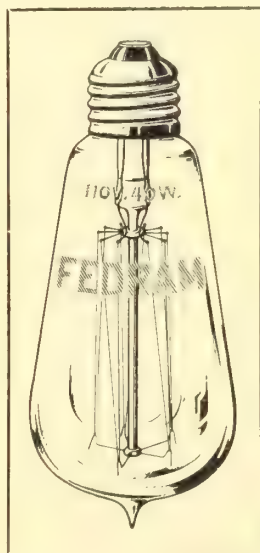
The main switchboard of the New York Central is a Krantz.

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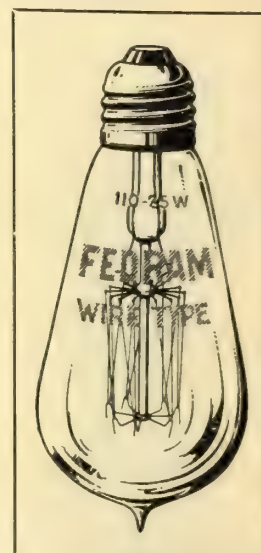
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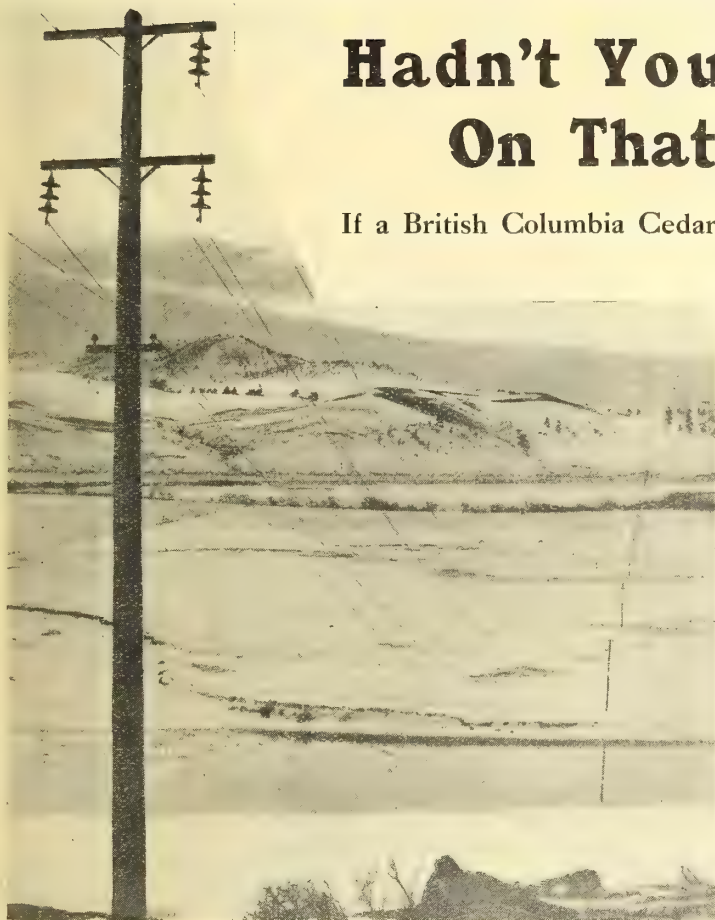
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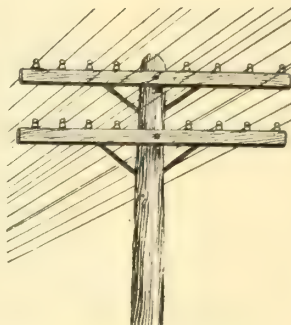
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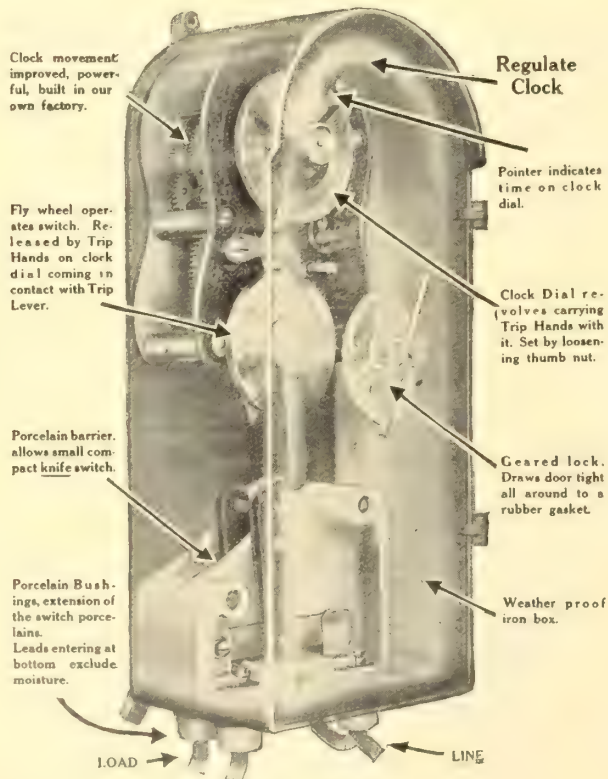
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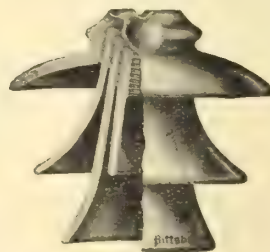
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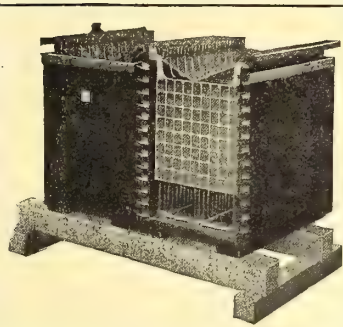
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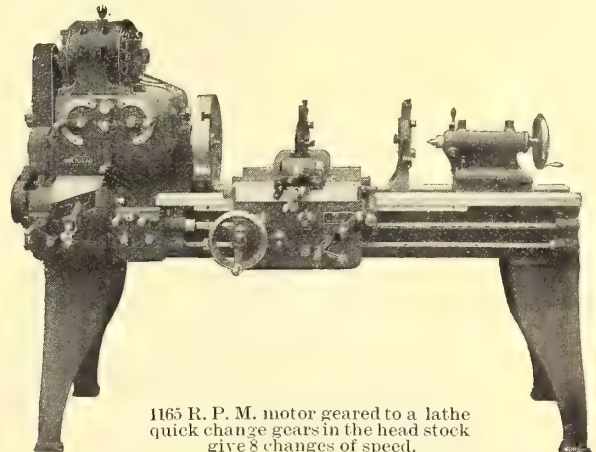
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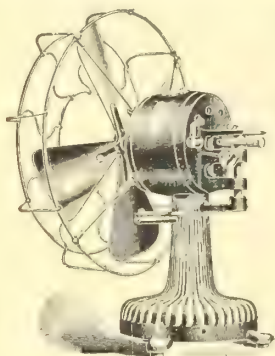
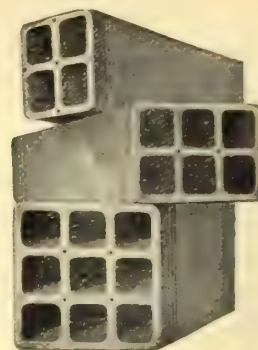
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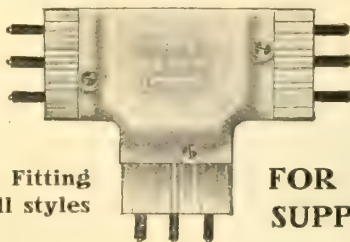
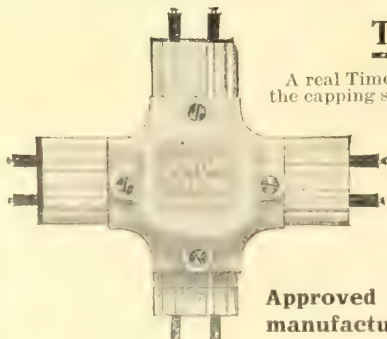
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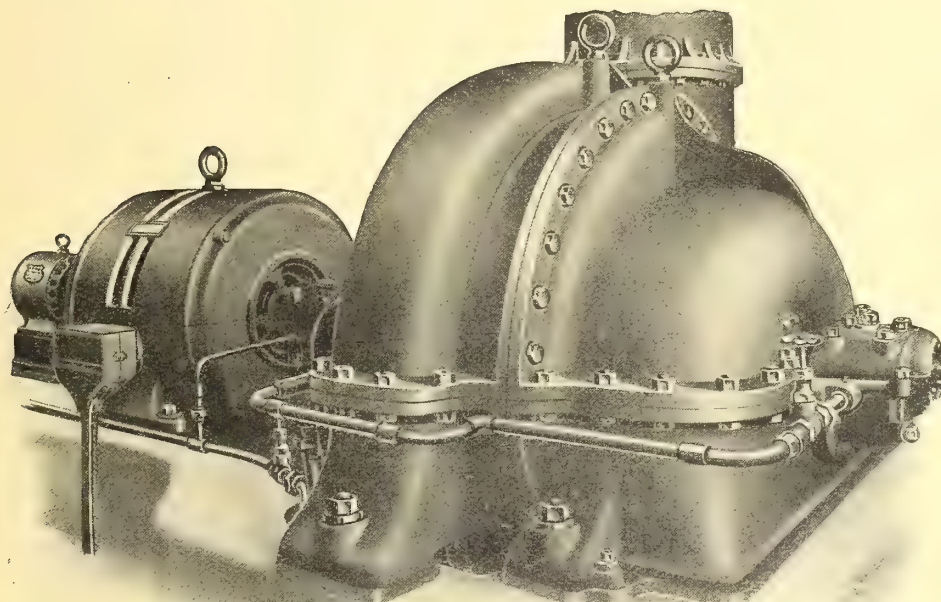
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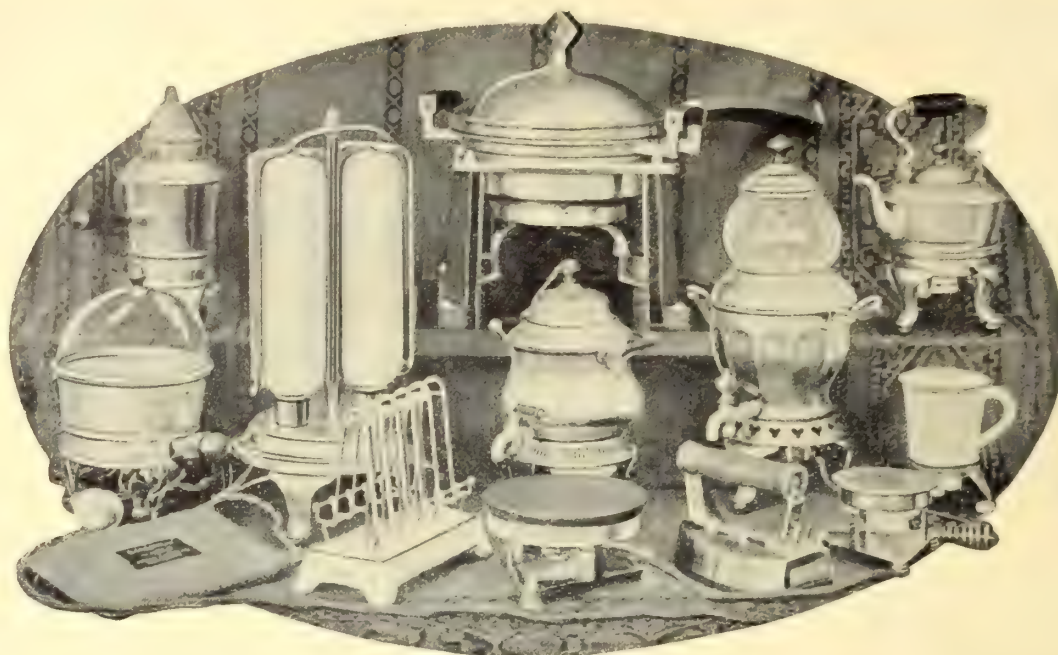
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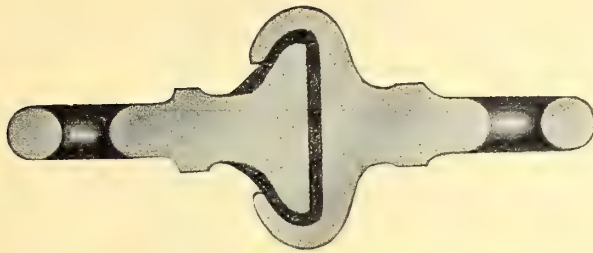
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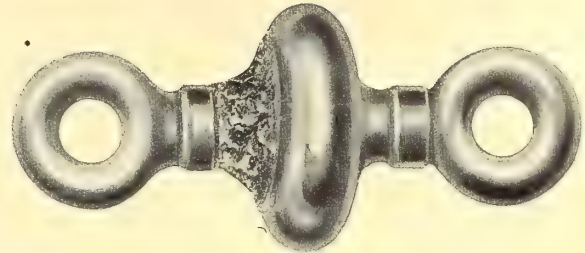
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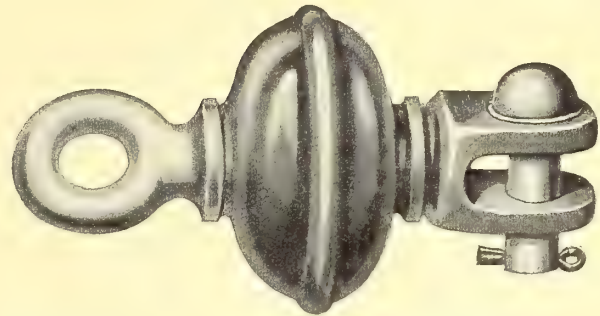


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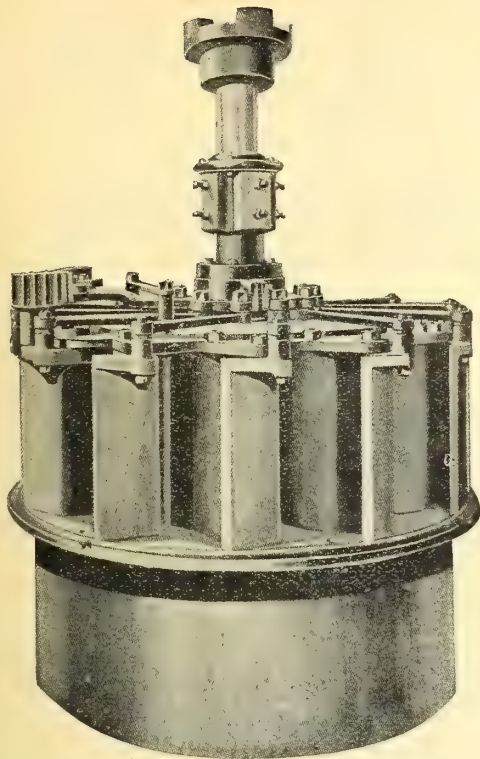
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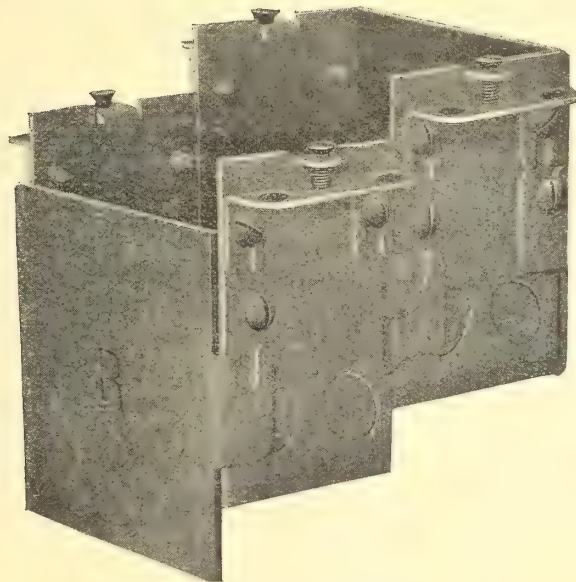
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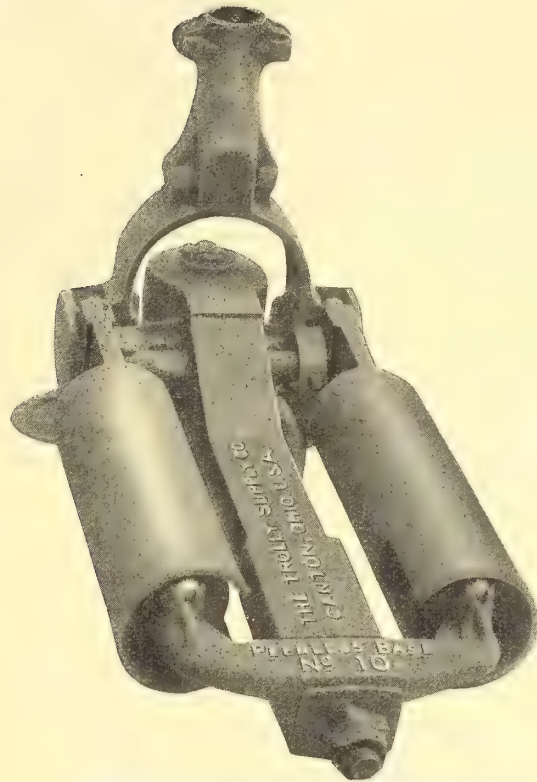
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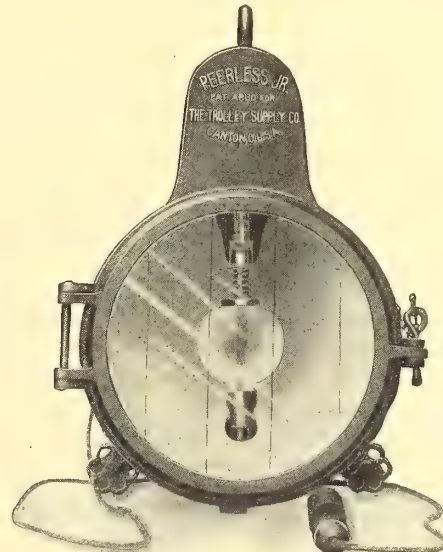
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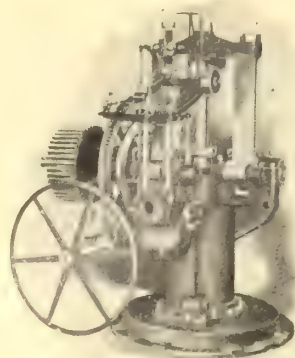
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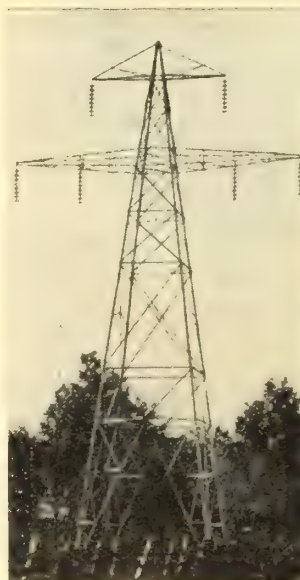
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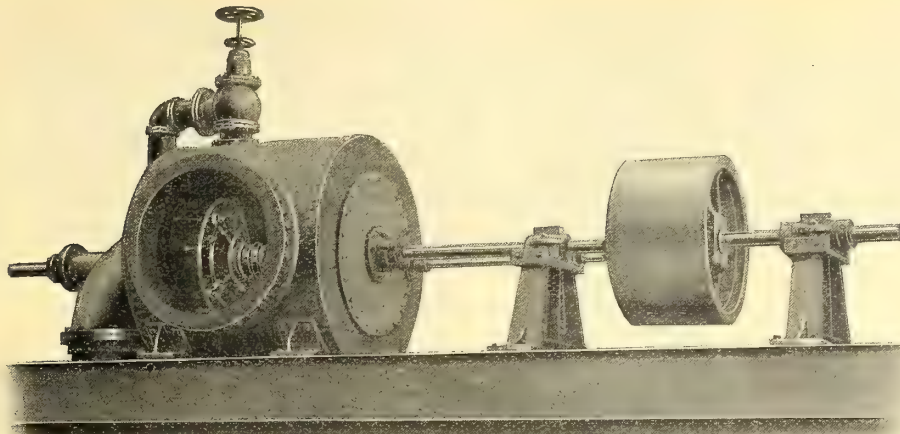
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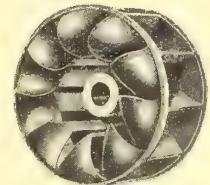


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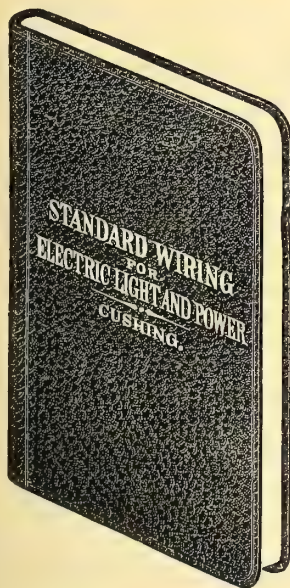
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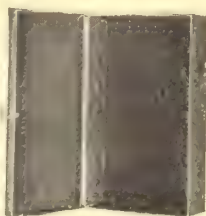
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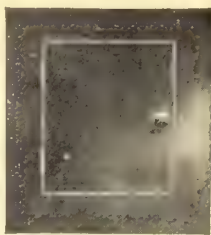


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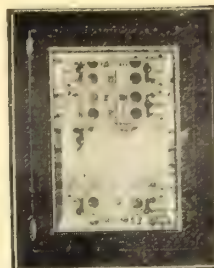
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Styles.



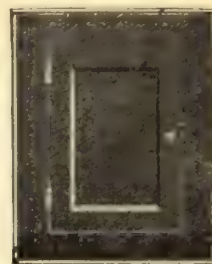
Type A. The usual box.
Dust tight cover.



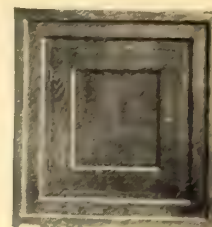
Type P. A cheap box
with a door and trim.



Type C. A better one
beaded and paneled.



Type G. With a beveled
plate glass panel in door.



Type SW. Steel, with
natural oak, mahogany
or walnut finish.

COLUMBIA—QUALITY—STEEL CABINETS

Lower Priced. Get Acquainted Now. Write: COLUMBIA, 226 E. 144th ST., NEW YORK

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Miners, Exporters and Dealers in
Canadian Amber Mica.

Thumb Trimmed, Cut to Size,
Splittings, Discs, Washers, Etc.

Write us for prices and let us figure on your
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The Canada Sales Company of Winnipeg, Manitoba

with agents in all the leading centres of population
in Northern Ontario, Manitoba, Saskatchewan and
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Electrical material and apparatus.

Their electrical department is strong and aggressive
and can produce results. *Correspondence solicited.*

The Canada Sales Company
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If any of our Red Seal Dry Batteries do not give
satisfactory service for Ignition or other work we
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The Dealer is authorized to make good this guarantee

The Manhattan Electrical Supply Co.

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Desk, Oscillating and Stationary Types

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Complete Lines in Stock

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MONTREAL

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? Have You Received the ? "Story of Number Five" ?

It tells how electric cooking is made practical in every household as exemplified in

Simplex Electric Ranges

and especially about size Number Five that will do all the cooking for 4 or 5 persons at a cost of less than a kilowatt per day, per person.

Write for the
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We make 15 standard sizes of Domestic Ranges—special types for Hotels, Restaurants, Institutions, etc.

Have you an ample supply of Simplex Travelers Stoves? All parts packed in the cup. Now is the time to see them.

SIMPLEX ELECTRIC HEATING CO.
BELLEVILLE, ONT.

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And, nine cases out of ten, that transformer is a

Thordarson Bell-Ringing Transformer



Thordarson Bell-Ringing Transformers are the best bell-ringing transformers made. They are dependable, inexpensive, small, light, compact and practically indestructible. Alternating current only. "Junior" type rings bell up

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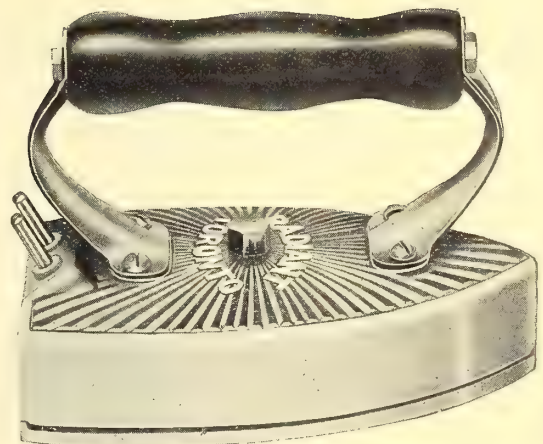
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RADIANT ELECTRIC IRONS

are good irons. There are probably more Radiant irons in use in factories in Canada than any other make.

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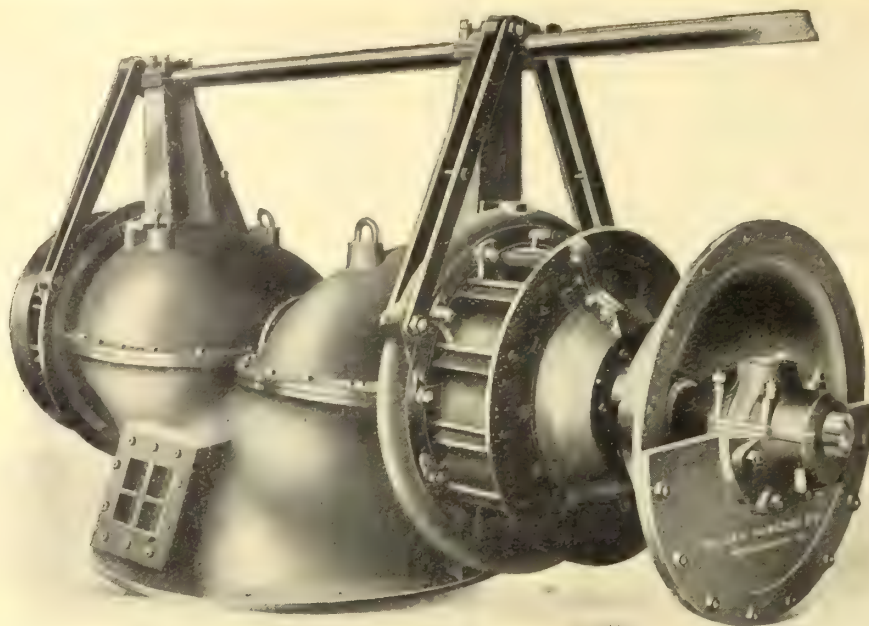


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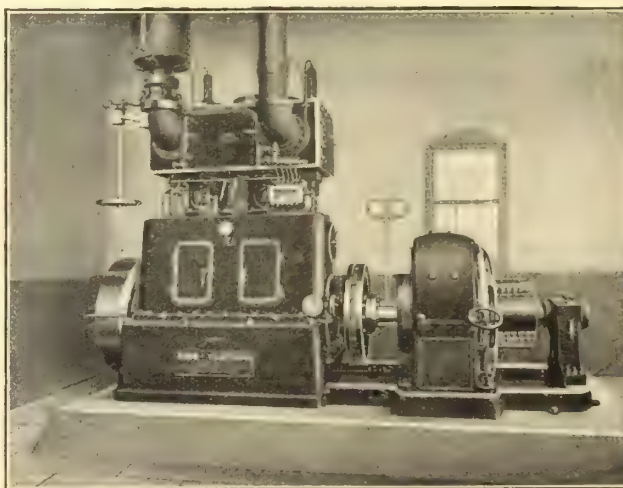
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For All Power Purposes

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Send
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Types,
Sizes,
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etc.



For
Direct
Connection
to
Electric
Generators
of all
Types

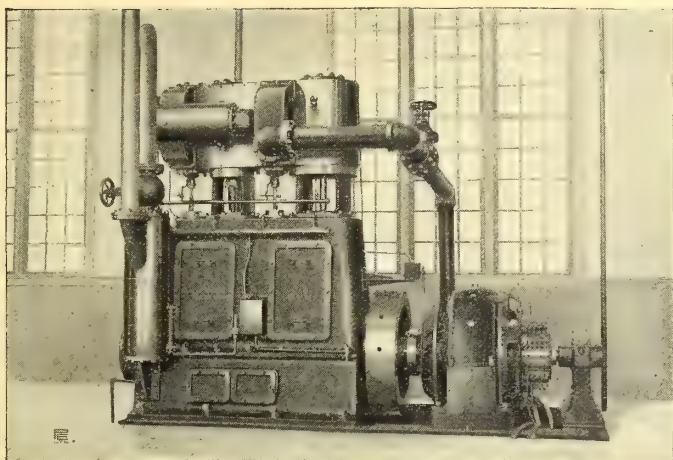
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Economical in Upkeep and in Floor Space required.

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This Engine is 150 H. P. Direct Connected to 100 K.W. Generator.

When Building or Remodelling your Power Plant, be sure to get our Catalogues and Prices on Engines, Boilers, etc. **G. & McC.** Equipment means **STEADY SERVICE ALL THE TIME.**

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ESCHER WYSS COMP.

Head Office for Canada: 515 Canadian Express Building, MONTREAL, Quebec

Agents:

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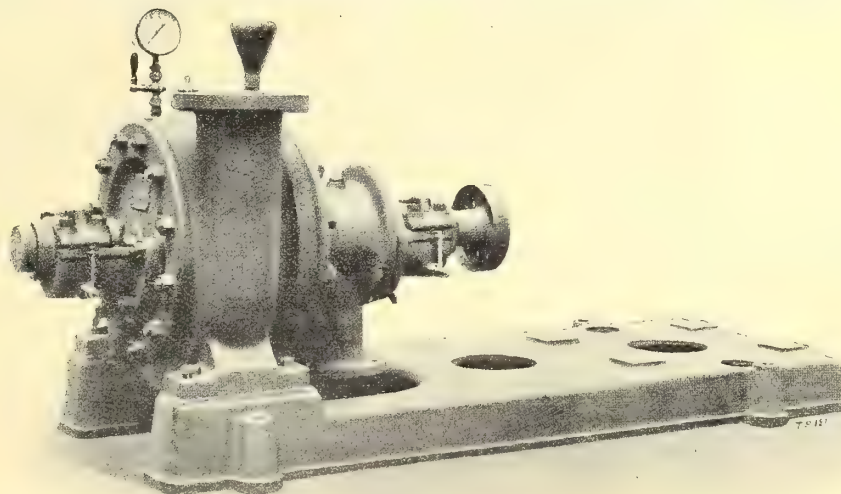
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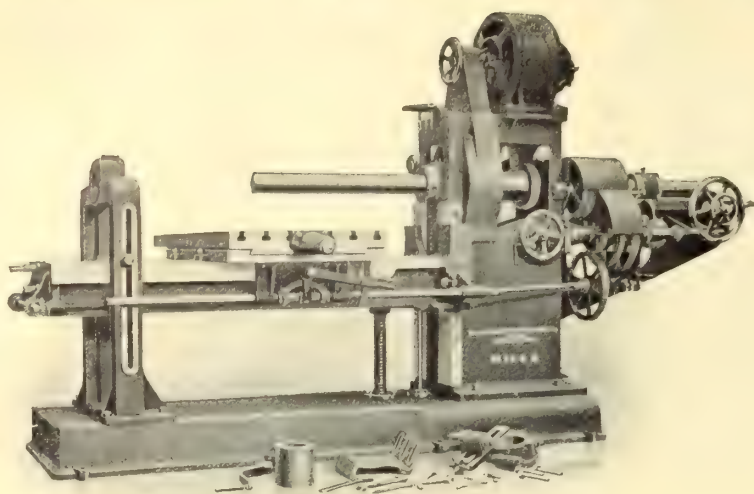
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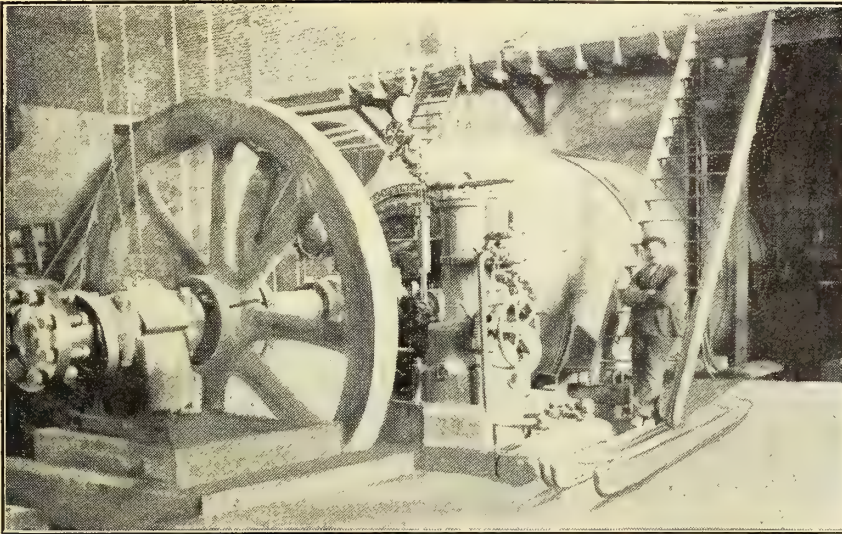
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Send us your inquiries and let us quote on same



The illustration shows one of the two 3,750 B.H.P. Turbines and Oil Pressure Governor Supplied to the Calgary Power Co.

Turbines

— and —

Governors

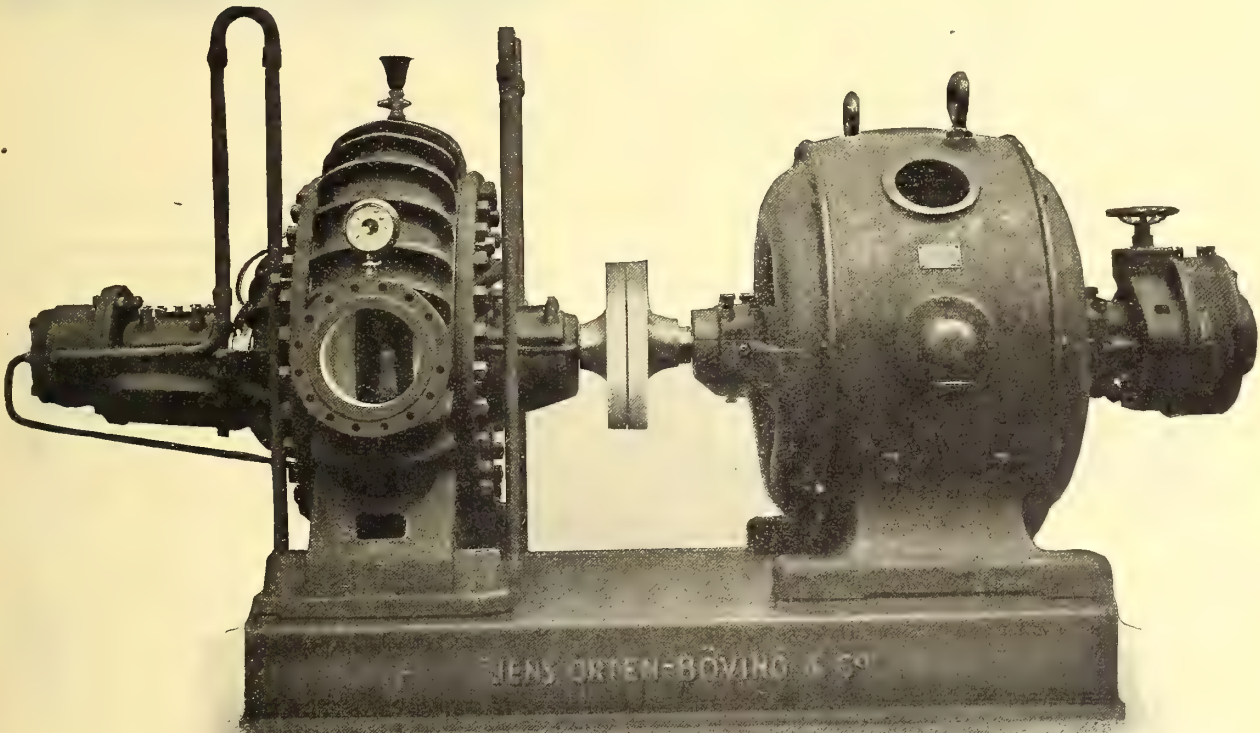
Seven Different Sizes of
Governors Made

Suitable for All Conditions

No Racks No Gears

Absolutely Self Contained

TURBO PUMPS FOR HYDRAULICING



The pump illustrated was installed by the Nipissing Mining Co. for sluicing purposes. A hill of gravel and stones being sluiced off the rock by means of a high pressure jet produced by this pump.

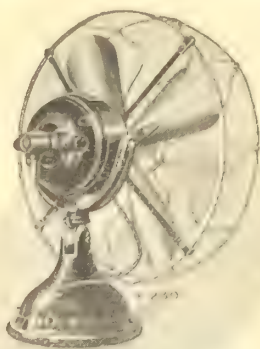
HEAD 415 FEET—CAPACITY 4,000 IMP. GALS. PER MIN.—710 B.H.P.

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PIPE 164 Bay Street, TORONTO **LINES**

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"STANDARD" FANS

give the greatest opportunity to the dealer of securing a big trade in this line.

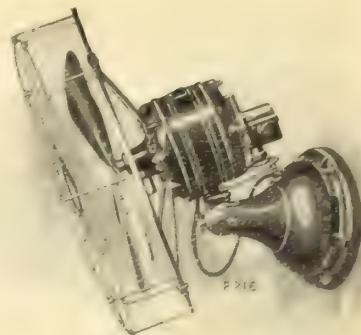
The exceptional convenience and beautiful finish make a special appeal to the public. They

Work Well, Live Long and Give no Trouble

All Desk and Oscillating Fans are adaptable to Desk or Bracket position and are readily changed with one movement. Every useful improvement and up-to-date device is found in "STANDARD" FANS.

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THE ST. JOHN RAILWAY CO.
ST. JOHN, N.B.



Clear and Legible by
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Blazing and Brilliant by
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FLEXLUME DAY-NIGHT SIGNS

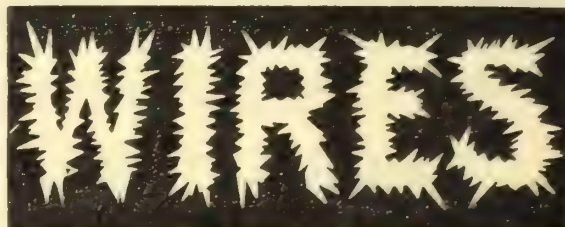
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70% to 80% Saving in Current

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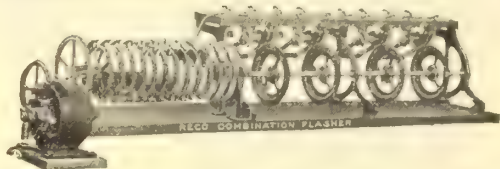
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for Electric Signs and Displays,
New designs:—Roller bearings
adjustable, trouble-proof.



Used by principal Sign Manufacturers in United States and Canada.

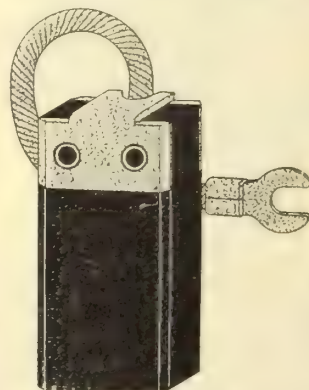
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Reynolds Electric Flasher Mfg. Co.

Largest Manufacturers of Flashers in the World.
Also Manufacturers of Billboard Reflectors, Time Clocks,
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INCREASE Current Output.
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Why experiment.
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Samples gladly sent.

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Billings & Spencer
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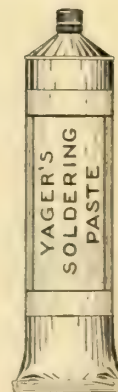
Drop Forgings

WELLAND, ONT.

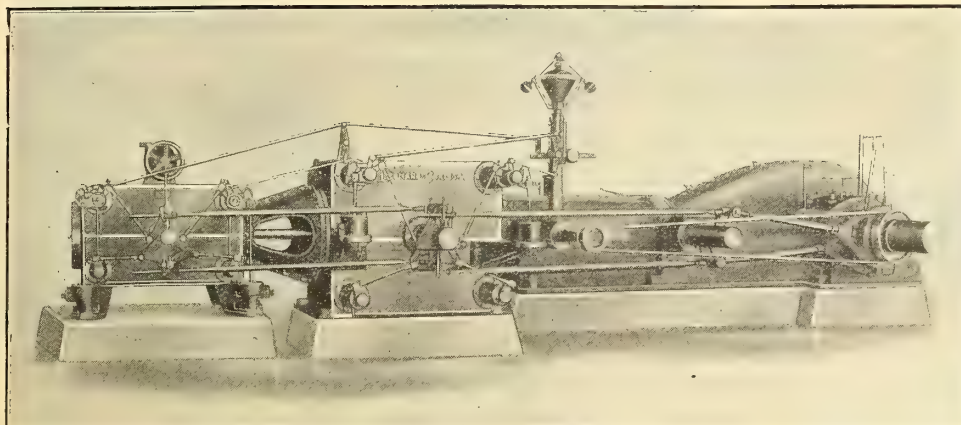
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Yager's Soldering Salts have been
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are none better for **Quality and Ser-
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FLUXES made from the base of
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Leonard Corliss Heavy Duty Tandem Compound Engine



for Medium and
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100 to 235 R.P.M.

Built in Units up
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Power

These engines are
Absolutely Noiseless,
are of **Massive Design**
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The **Frame**, including guides and main bearing, is cast in one solid piece, thus insuring greatest rigidity. **High Economy** is the particular feature of this engine.

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Close Regulation—Plus

Plus exceptional strength—plus simplicity—plus the satisfaction that a good engine properly designed, properly built and properly equipped will give.

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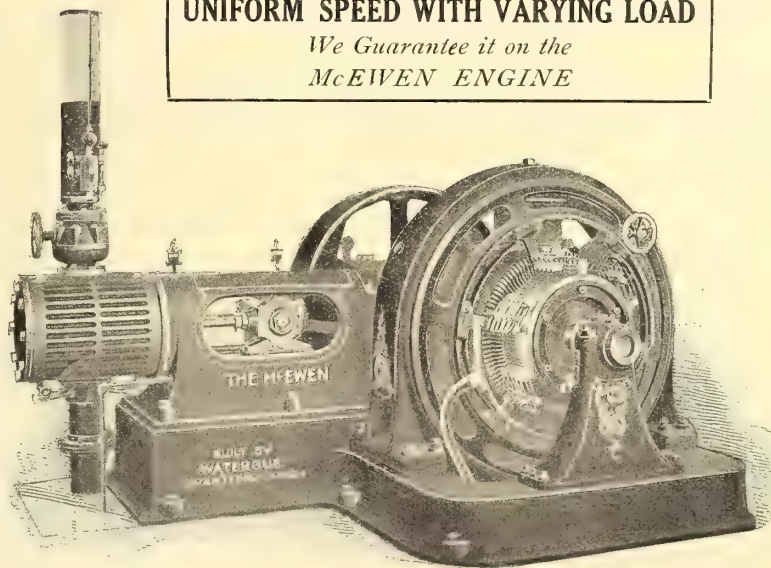
A high-grade, high-speed automatic engine that direct connected to a dynamo, presents the ideal installation for the economical generation of electric light and power.

Its merits have been shown under all conditions - good, bad and indifferent — of actual practice.

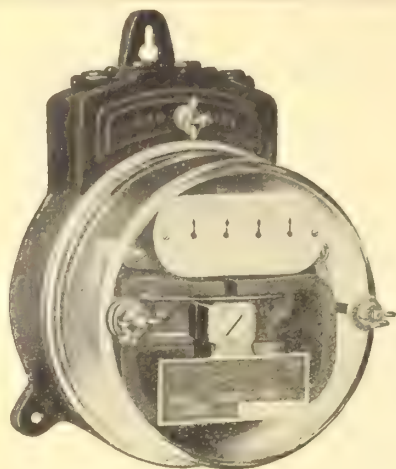
We build all sizes, simple and compound up to 700 h.p.

UNIFORM SPEED WITH VARYING LOAD

*We Guarantee it on the
McEWEN ENGINE*



The Waterous Engine Works Co., Limited, Brantford, Can.



The service accuracy of Westinghouse Watthour Meters is due to the efficiency of the bearings and register.

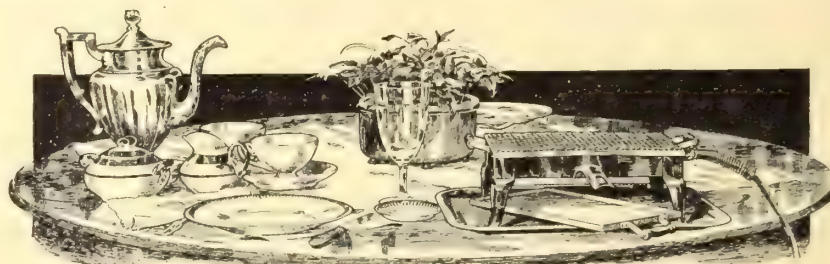


These parts are "featured" in Westinghouse Watthour Meters. For example: The use of "Ball Bearings" insures maximum "Service Accuracy" and, incidentally, low maintenance costs. Burnished steel shafts and the gold plating of all gears, prevents the deterioration of the register under service conditions.

The eleven different inspections given the sapphire jewel are an illustration of the care used to insure perfection of product. This "manufacturing efficiency" is reflected in the high "service accuracy" of Westinghouse Watthour Meters.

Canadian Westinghouse Co., Limited, Hamilton, Ontario

Toronto Traders Bank Bldg. **Montreal** 52 Victoria Square **Halifax** Telephone Bldg. **Winnipeg** 158 Portage Ave. E. **Calgary** 311 8th Ave. W. **Vancouver** Bank of Ottawa Bldg.

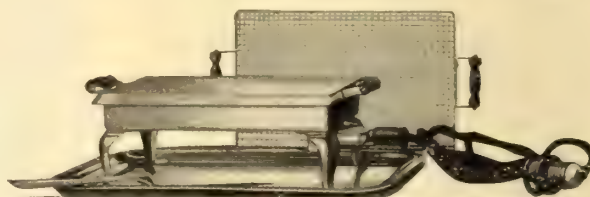


Strike while the weather's hot. Now is the time of year when it's easier to sell

Westinghouse Electric Toaster-Stoves

You can demonstrate to you customer how they can prepare a meal outside of the kitchen, in the coolest room in the house, or on the porch. A lamp socket is all that is required, the toaster stove will do the rest. ¶ It makes toast, broils, fries or boils right on the table. A self-contained little stove.

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Quick Thorough Repairs to all makes of Electrical Apparatus.

Remote Control Solenoid Switches for economical tungsten or incandescent street lighting from existing house lighting system.

The Best Carbon Brushes in America for Electrical Machinery.

Used Electrical Machinery of all descriptions.

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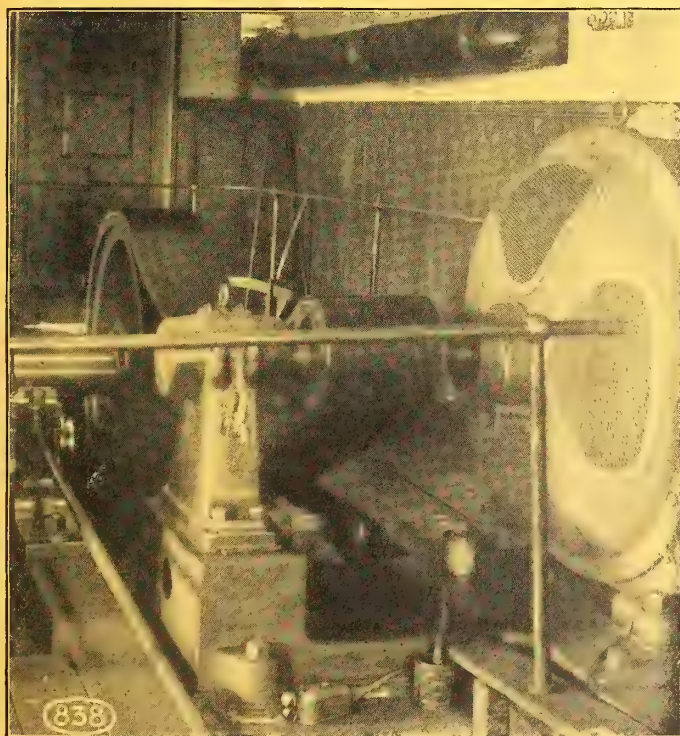
The Electrical Maintenance & Repairs Co., Ltd.

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Phone Adelaide 902-903

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(Hans Renold are the oldest and largest manufacturers of Steel Driving Chains in the world)



(Renold Silent Chain driving 150 H.P. Main Colliery Haulage Gear)

TRANSMITS ANY POWER FROM $\frac{1}{4}$ H.P. to 2,000 H.P. QUIETLY

Send us following details of any troublesome drives or new drives and we will give promptly full information re chain driving.

Maxim H.P. to be transmitted

Distance between centres of shafts.....

Revolutions per minute.....

Diameter of shaft

DRIVER	DRIVEN
.....
.....

Is a split sprocket wheel necessary? Yes or No

What is the chain required to drive

Can Shaft Centers be adjusted

Is the load steady or impulsive, as with pumps.....

Is the drive perpendicular or horizontal?.....

A Sketch of the drive is always of great assistance

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Sole Canadian Agents

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Modern Practice Demands G & W SPECIALTIES

NEW AND ORIGINAL IDEAS BY PRACTICAL
ELECTRICAL ENGINEERS

POT HEADS

DETACHABLE, NON-DETACHABLE, COMBINATION
INSIDE AND OUTSIDE USE—ALL VOLTAGES. THE
ORIGINAL POT HEAD WITH WIPING ELIMINATED.

SUBWAY JUNCTION BOXES, SERIES
SWITCHES, COMPOUND, PRIMARY CUT-
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DETECTORS, AND MANY OTHER DEVICES

Any pole or manhole can be made a switching and testing point at small cost through the use of G & W Devices.

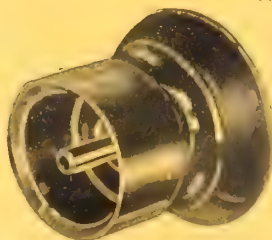
We can refer you to many installations in use for over six years, in many parts of the country.

G & W Electric Specialty Co.

6408 Jackson Park Avenue
CHICAGO, U. S. A.

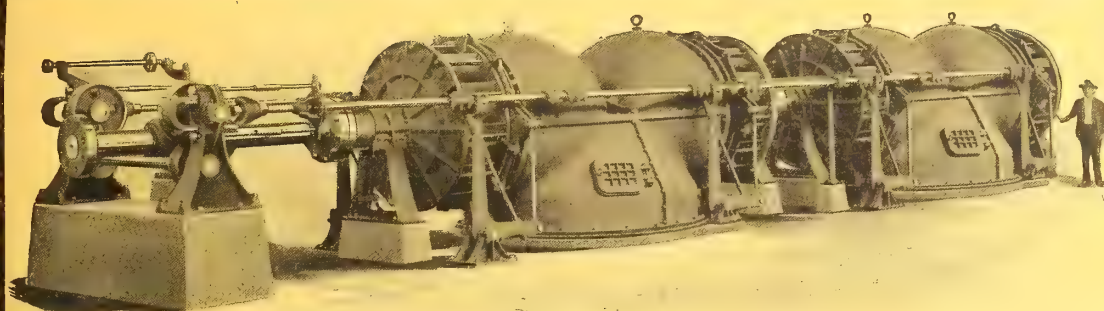


Type "MHS," 2, 3, or 4
Conductor.
30,000 Volts. One of many types



Electrical News

Generation, Transmission and Application of Electricity



Hydraulic Turbines

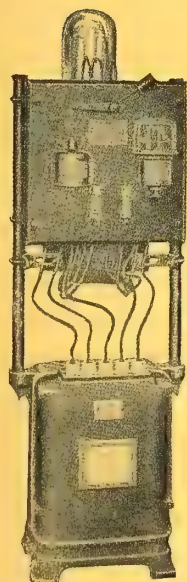
One Unit of Turbines of 3,200 H.P. 30' Head Furnished

J. R. BOOTH, Ottawa, Canada

Turbines Furnished for Heads from 5 feet to 600 feet.

Branch Offices:
167 Federal St., BOSTON, MASS.
American Trust Bldg., CHICAGO

S. Morgan Smith Co., York, Pa.



Moving Picture Rectifier

Mercury Arc Rectifiers

A simple method of correcting light loads.

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No moving parts—require no oil.
Can be operated by man or woman.

For Battery Charging of All Kinds

Will deliver direct current wherever alternating current is available.

8,000 Rectifiers are used for charging Electric Vehicles.



Battery Charging Rectifier

Canadian General Electric Co., Limited

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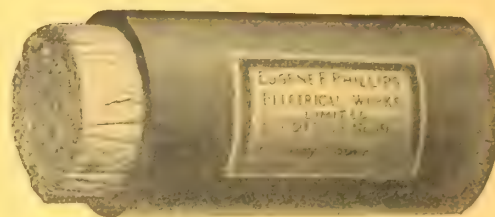
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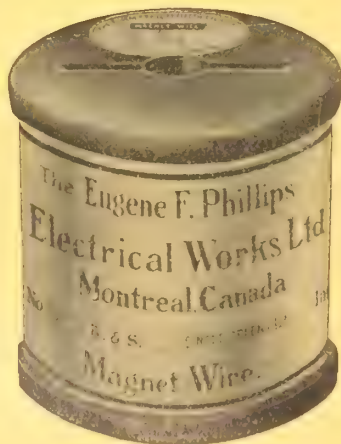
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For Telephone, Telegraph, Lighting,
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Railway, Feeder and Trolley Wire



Weatherproof Magnet
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Branches: Halifax, Toronto, Winnipeg, Vancouver

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When you want the goods you need them

When you need the goods you want them

Save yourself the worries and delays you experience in importing goods from other countries

We Manufacture and Carry the Stock

right here in Canada and make immediate deliveries from

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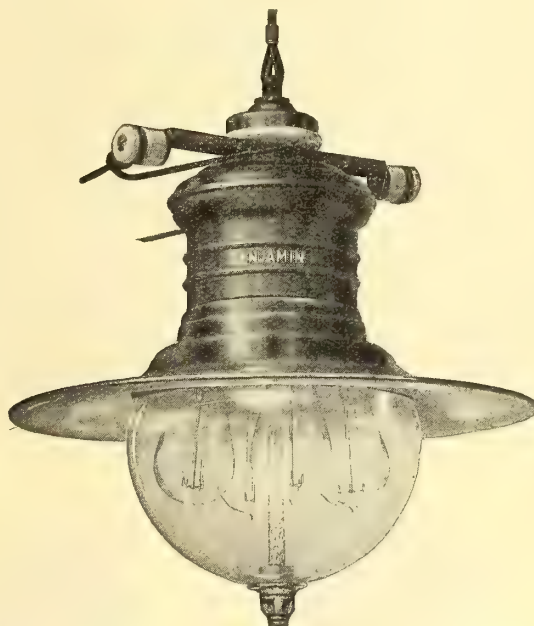
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Reflector Sockets

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Specialties



Cat. No. T 74

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Federal Sockets

Wirt Insulating Joints

Insulated Screw
Drivers

Series and Multiple
Street Fixtures

Special Fixtures

“BUY BENJAMIN”

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ALL JOBBERS CARRY A STOCK OF “BENJAMIN”

Write for Catalog C-20

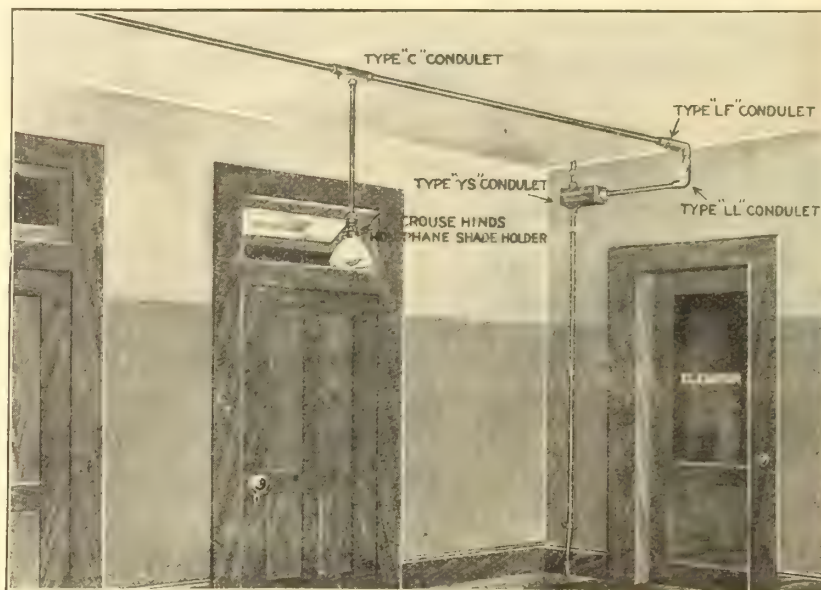
Benjamin Electric Manufacturing Co.,
of Canada, Limited

TORONTO - - - - - ONT.

For Plug or Cartridge Fuse Cut-Outs

Condulets—"Y" Series

Embody all requirements and recommendations of National Board of Fire Underwriters. Box and threaded hubs are a specially designed one-piece iron casting. Cover is of No. 10 gauge sheet steel, securely hinged at back, and closes snugly over rabbet on edge of casting. Spring catch, operated by knob on top of cover, holds latter tightly shut. A universal plate for cut-outs and all necessary screws, but not cut-out, are furnished with each Condulet. Cut-out plate is mounted on pillars a half-inch above floor of Condulet, thus allowing free passage of wires not connected with cut-out. "Y" series of Condulets include sizes for 2 and 3 wire main line, 2 to 2 and 3 to 3 wire single branch and 2 to 2, 3 to 2 and 3 to 3 wire double branch cut-outs.



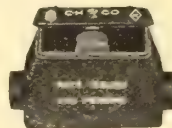
Type "YS" Condulet Installed in Hallway



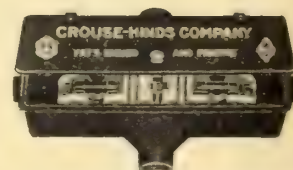
Type "YD"—for Double Branch Cut-Out, Dead End



Type "YS"—for Single Branch Cut-Out, Through Feed



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Type "YZ"—for Double Branch Cut-Out, Through Feed

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Crouse-Hinds Company of Canada, Limited



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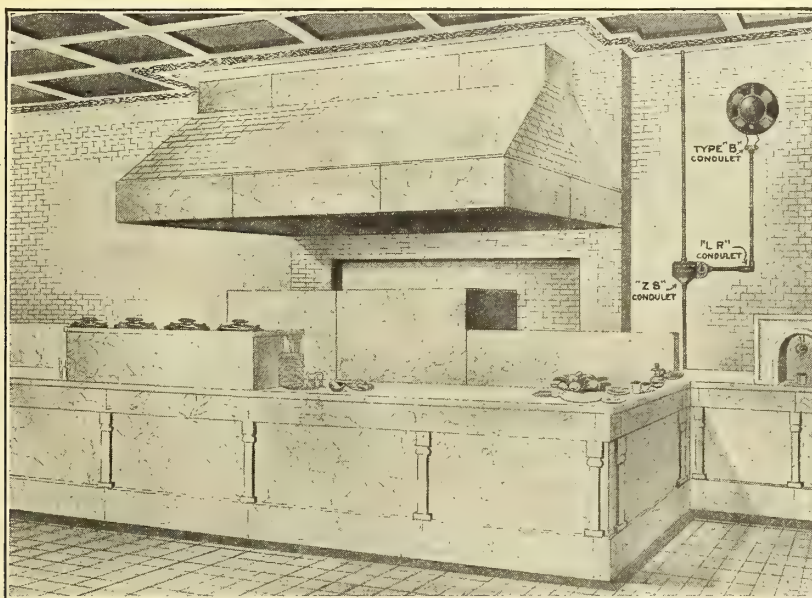
Toronto, Ont., Canada



For Cut-Outs and Snap Switches

Condulets—"Z" Series

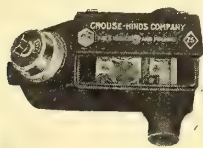
Provide for 5, 10 or 20 ampere switches in addition to plug or cartridge fuse cut-outs. Take place of separate cut-out boxes for switches and fuses, besides being stronger, easier to install and more sightly. Have all good qualities of "Y" series shown on opposite page, including structural advantages, plus accommodation for switches. Full complement of adjustable swivels for 5, 10 and 20 ampere switches and universal plate for cut-outs, but neither switches nor cut-outs, furnished with each Condulet. "Z" series includes sizes for 2 and 3 wire main line, 2 to 2 and 3 to 3 wire single branch and 2 to 2, 3 to 2 and 3 to 3 wire double branch cut-outs. Main line and single branch cut-outs, each arranged for single switch; double branch cut-outs, for two switches.



Type "ZS" Condulet Installed in Lunch Room



Type "ZD"—for Double Branch Cut-Out, Dead End, Switch on Each Branch



Type "ZS"—for Single Branch Cut-Out, Through Feed, Switch on Branch



Type "ZC"—for Main Line Cut-Out, Through Feed, Single Switch



Type "ZX"—for Double Branch Cut-Out, Through Feed, Switch on Each Branch

Order From Your Dealer. If He Does Not Stock Them, Write Us

WRITE FOR CONDULET CATALOG, BULLETIN NO. 100—SENT FREE TO ANY ADDRESS

Crouse-Hinds Company of Canada, Limited



Main Office and Works:

Toronto, Ont., Canada



ADANAC Red Core Rubber Covered WIRES & CABLES



Adanac Red Core Rubber Covered Wires and Cables

are made according to the specifications of the National Board of Fire Underwriters. The conductors are drawn from copper of the highest conductivity and are covered with two thicknesses of thoroughly vulcanized rubber compound of high quality. The wires are braided over insulation and the smooth high finish they receive makes them specially desirable for conduit work.

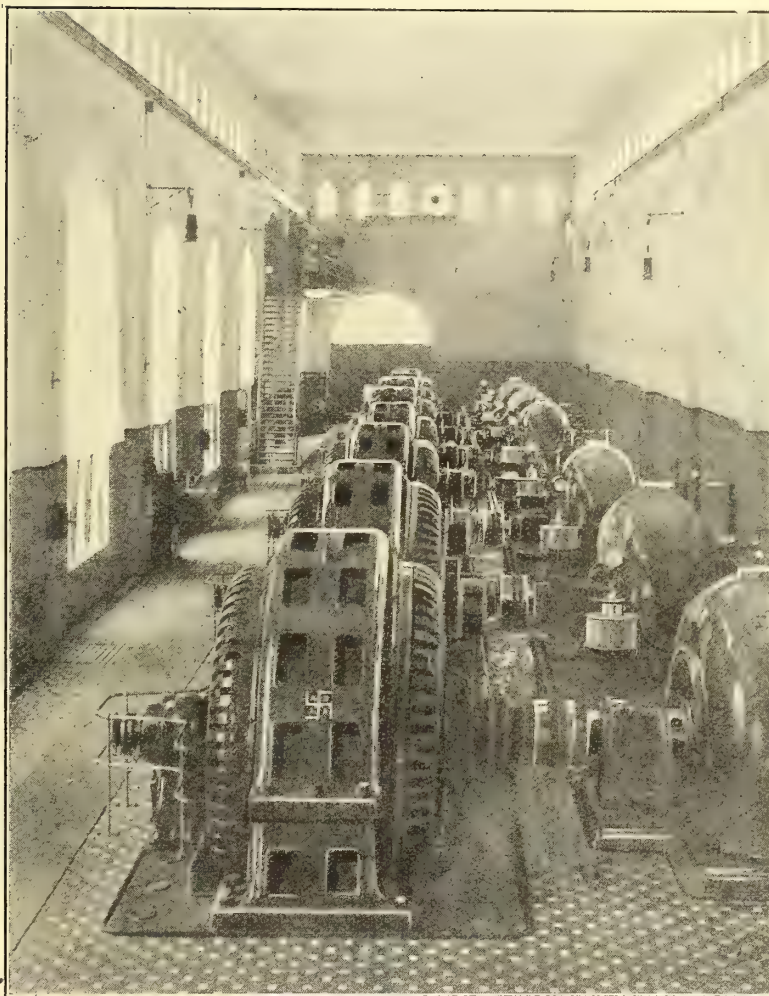
IMPERIAL WIRE & CABLE COMPANY Limited MONTREAL

THE Northern Electric
AND MANUFACTURING CO. LIMITED
SALES AGENTS

TORONTO WINNIPEG
REGINA
CALGARY VANCOUVER

High Grade Electrical Apparatus

A. C. Generators
 A. C. Motors
 Switchboards
 Transformers
 D. C. Generators
 D. C. Motors
 Electrical
 Machinery for
 all Purposes



Our Machines
 are
 Manufactured
 from the
 Highest Grade of
 Material
 Obtainable
 for Electrical
 Purposes

Six 4,100 K.V.A. 12,000 Volt 25 Cycle 3 Phase 375 r.p.m. Generators
 Installed at Tysse Falls, Norway

Kilmer, Pullen & Burnham, LIMITED

Head Office,
 TORONTO



Branch Offices: MONTREAL
 General Supplies Ltd.,
 CALGARY, ALTA.

SOLE DEALERS FOR
 The General Electric Co., of Sweden

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tion Co.	24			Standard Wiring	105
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Company	111	National X-Ray Reflector Co.	35	Zimmerman Co., W. H.	96
Economy Fuse & Mfg. Co.	35				

The Advertisements in the "Electrical News" represent the leaders in their line

W. T. GLOVER & CO., LTD.

ELECTRIC WIRE & CABLE MAKERS



“
GLOVERS DRUM MAJOR.
”

CANADIAN HOUSE:
207 Lumsden Building, Yonge St., TORONTO, ONT.

HEAD OFFICE AND WORKS:
TRAFFORD PARK, MANCHESTER, ENGLAND

"Galvaduct" and "Loricated"

The Conduits that can be Depended
on for Long and Efficient Service



HEAD OFFICE, BANK OF TORONTO, TORONTO, ONTARIO.

Bank of Toronto—A Galvaduct Building

QUALITY AND DURABILITY

are essential features in Conduits. These qualities are found in the highest degree in "GALVADUCT" and "LORICATED".

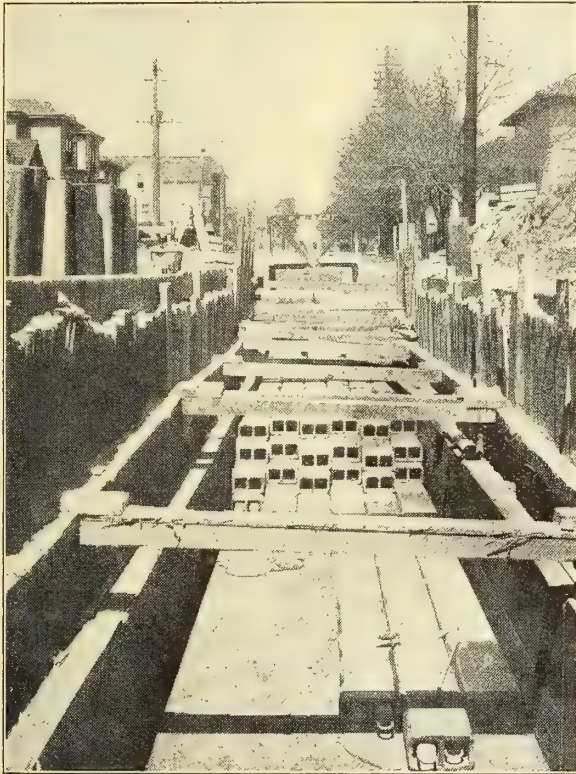
The work of installing good Conduit costs no more. Besides they eliminate unexpected and often disastrous mishaps.

Always specify the Conduits made by

Conduits Company Limited
Toronto and Montreal

G. M. GEST

Conduit Engineer
and Contractor



Electrical Underground Conduit Systems

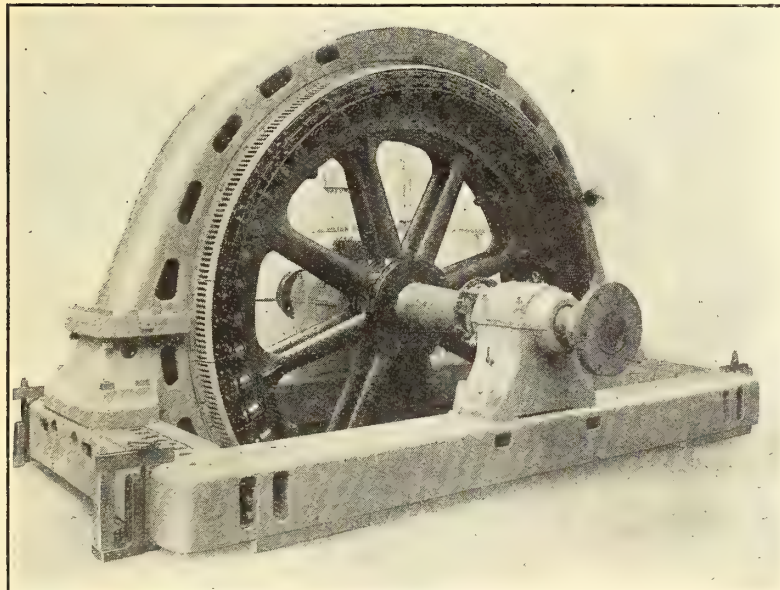
When **G. M. GEST** designs and constructs your Conduit System you receive the benefit of many years' experience and specializing in that line of work.

Power Building, Montreal, P.Q.

VICKERS LIMITED

Generators and
Motors
of all types
for Alternating
and Continuous
Currents.

Rotary Convertors,
Motor - Generators,
Turbo Alternators.



Patent Reversing
Drive for
Planing Machines.

Complete
Equipments for
the electrical
lighting and
driving of machine
shops,
factories, mills,
etc.

3,000 K. W. 3 Phase, 6,600 volts, 60 cycles, 164 R.P.M. generators, direct coupled to water turbine under head of 45 feet. One of five machines by Vickers Limited to the order of the Winnipeg Municipality.

Head Office for Canada: Lewis Building, Montreal
Mr. J. F. I. Thomas (Representative)

Works:
River Don Works, Sheffield, England

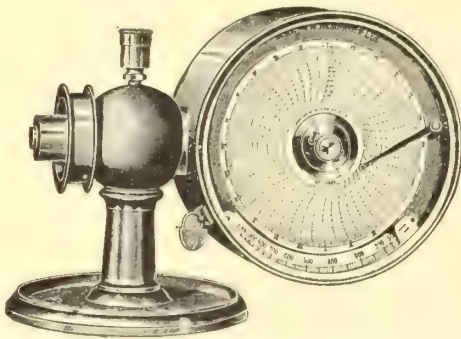
S & B "Columbia" Tachometers

Tachometers, as you know, are solvers of speed problems. They are designed to show instantaneously the speed in R.P.M. of any shafting, engine, machine, motor, turbine or the like.

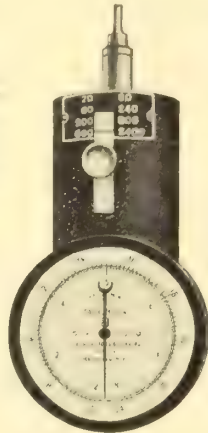
Among our line of stationary tachometers will be found an instrument for every purpose and condition.

The Recording Type has gained much popularity. It furnishes a written record of speed maintenance.

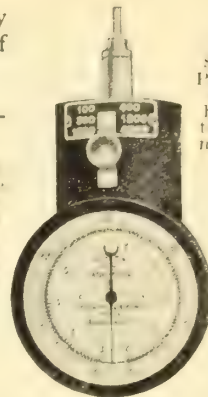
An indicating and recording type of stationary tachometer



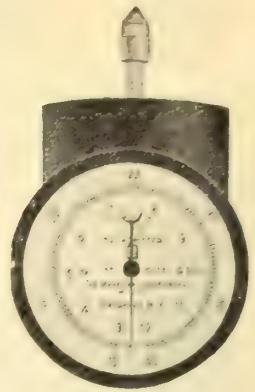
A single spindle four range type hand tachometer



A single spindle three range type hand tachometer



The S & B Pocket type hand tachometer



Our line of Hand Tachometers is complete. There are many styles at varied prices.

They are constructed on the most modern principles, are very compact and durable and are extremely accurate. In appearance they are exceptionally handsome.

Write for pamphlet W 23

A full line will be on exhibit at our booth at the coming Industrial Exhibition

The Schaeffer & Budenburg Mfg. Company
CHICAGO BROOKLYN, N. Y. PITTSBURGH

89

The best lamps for outside service are our

TUNGSTEN ARCS

They are also the most suitable for factories or warehouses.

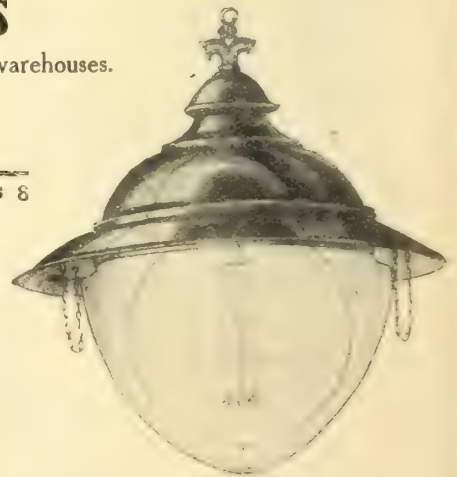
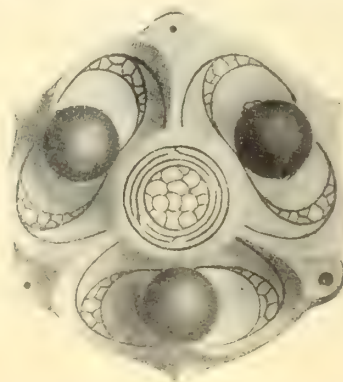
**Absolutely Watertight
Weatherproof**

Contain 1, 2, 3 or 5 tungsten lamps

Majolica Fixtures



The Majolicas are the newest porcelain fixture creations and they are very popular for bathrooms, verandahs or halls.



Will go with any decoration. Nothing to corrode, rust or look old when used as an outside fixture.

Electrical Products Company, of Canada
28 Wellington St. West (Tel. Main 2298) Toronto

Maximum Strength—Minimum Weight J-M FIBRE CONDUIT

Affords absolute protection for electric wires underground, protection from mechanical injury, water, gas and acids.

It is the strongest conduit made. A 300-pound load on its weakest part won't break it. Minimum loss—low depreciation—long life.

Weighs one-sixth as much as clay conduit; costs only one-sixth as much



for transportation, and the cost and time for laying are less.

Furnished with bell or straight joints in four styles: Socket, Drive, Sleeve and Screw, together with fittings and bends to meet all conditions of service, and made in standard tube lengths 2 to 4 inches in diameter, bell joint 54 inches and straight joint 60 inches long.

Write our nearest house for booklet on J-M Fibre Conduit

The Canadian H. W. Johns-Manville Co., Ltd.

Manufacturers of Asbestos
and Magnesia Products

ASBESTOS

Asbestos Roofings, Packings,
Electrical Supplies, etc.

TORONTO

MONTREAL

WINNIPEG

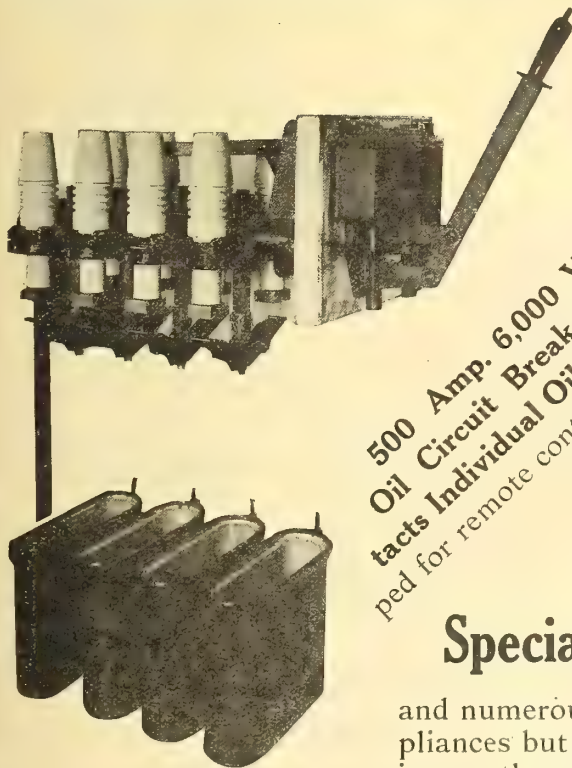
VANCOUVER

Monarch Electric Company, Limited

St. Lambert, P.Q.

DISTRICT MONTREAL

Phone: Main 3988
Montreal Exchange



500 Amp. 6,000 Volt Automatic
Oil Circuit Breaker Laminated Con-
tacts Individual Oil Tanks. Can be equip-
ped for remote control.

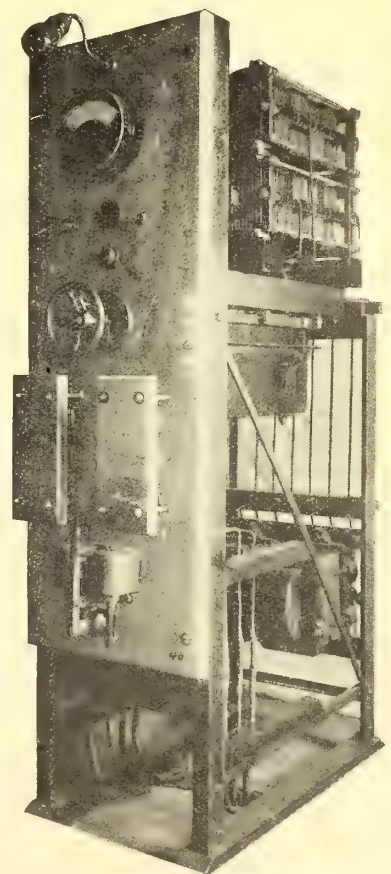
We
manu-
facture

**Electrical
Specialties,
Switchboards,
Switches**

Special Transformers

and numerous other Electrical Ap-
pliances but space prohibits enlarging
on them in this issue.

300 H.P. 2500 VOLT MOTOR STARTING EQUIPMENT





Induction

Long Life Bearings
High Power Factor
Great Overload Capacity
Conservative Rating

The manufacturers of induction motors may be divided into two schools:

Those who prefer the "open slot" construction and those who build under the "closed slot" principle. Each of these contends that their extreme is better than the other. The "open slot" advocates sacrifice electrical qualities to mechanical convenience. The "closed slot" adherents gain the highest electrical advantages, but have a motor which is very inconvenient mechanically.

By means of the special arrangement of the end-rings shown in the illustration, connections of uniform electrical resistance are provided, and all tendency toward local heating or concentration in one ring is avoided.



Motors

Generators

Transformers

Motors

Extra Strong Starting Torque
Unusually Heavy Insulation
Convenience of Repairs
Efficient Ventilation

In the C. W. motor the slots are first made open, allowing plenty of space for the inserting of heavily insulated form-wound coils, and are then closed by magnetic wedges which give all the electrical advantages of "closed slot" construction. The cut shows how the magnetic wedge "E" increases the distributing area of the tooth and allows the flux to travel a shorter path than is the case where the wood-wedge "P" is used.

For a further discussion of this subject and other interesting advantages of these motors write for induction motor booklet "E."

The C. W. motor has more bars in the rotor than any other similar motor. This results in minimum flux leakage and high torque. This is why it takes a greater overload to stop a C. W. Motor.

Canadian Crocker - Wheeler Co.

Manufacturers and Electrical Engineers

LIMITED

HEAD OFFICE AND WORKS: ST. CATHARINES, ONT.

BRANCH OFFICES: MONTREAL, QUE.
TORONTO, ONT. VANCOUVER, B. C.



AN INTERESTING CENSUS

From a careful census obtained direct from the power companies, it is found that there are in the United States, Canada and Mexico at Oct. 1, 1911, 4545 miles (single circuit) of high voltage power lines operating or being erected for which suspension, or underhanding type of insulators, have been purchased.

The voltages are divided as follows:

110,000 volts	1355 miles	
104,000 "	270 "	
90-100,000 "	1656 "	
60-75,000 "	708 "	
45-55,000 "	458 "	
Under 40,000 volts	88 "	4545

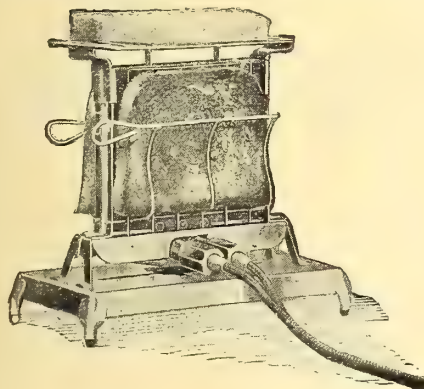
The insulators include those made in the U.S. together with all European insulators. Of this 4545 miles, 1795 miles are or will be equipped with "Victor" insulators, manufactured by

THE LOCKE INSULATOR MFG. CO., Victor, N.Y.

OR

Engineering Equipment & Supply Company

410 St. James Street,
MONTREAL, QUE.

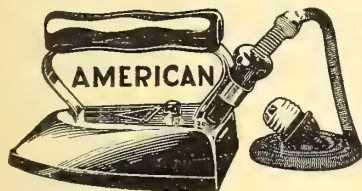
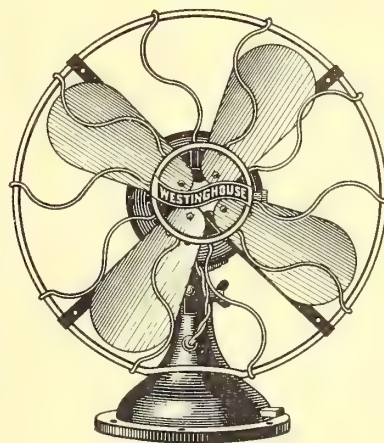


Summer Load Boosters that Appeal to the Users

The American Upright Toaster—Strong, compact and neat in appearance. Impossible to short circuit by using a fork when removing the toast. All parts electrically welded, no screws or rivets being used.

The American Beauty Iron—The electric heat is made inside the iron and is evenly distributed over the entire ironing surface. The heat being made inside the iron without flame, the iron surface stays smoothly and cleanly polished. When used on ordinary ironing work, the current need only be turned on about two thirds of the time as this iron accumulates and holds the heat. It carries a three year guarantee backed by both dealer and maker.

Westinghouse 8 inch Fan Motors are very popular for use in the home. They are inexpensive in first cost and very economical in the use of current. They weigh only 4½ pounds; have three distinct speeds and are very attractive in appearance. Booklet No. 2036 will be sent on request.



THE Northern Electric
AND MANUFACTURING CO. LIMITED

Manufacturers and Distributors of Telephone Apparatus, Electrical Supplies, and Fire Alarm Apparatus for every possible need.



MONTREAL

TORONTO

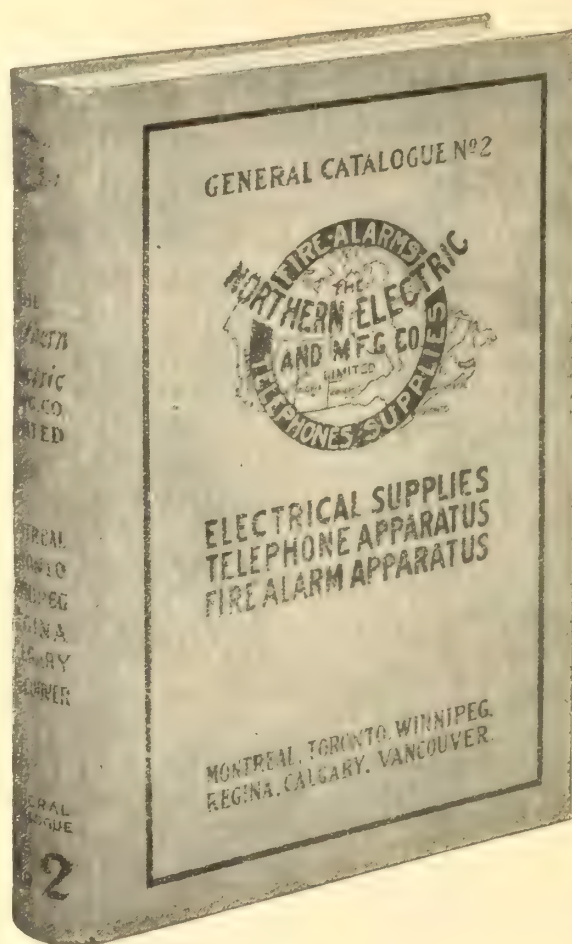
WINNIPEG

REGINA

EDMONTON

CALGARY

VANCOUVER



Our New General Supply Catalogue is Being Distributed

A copy will be sent to all those regularly engaged in the Electrical Business.

If your name is on our mailing list, you will receive a copy. If not, a request on your regular letter head, addressed to our nearest House, will bring one to you.

The Catalogue contains over 850 pages of strictly up-to-date Electrical Supplies, Telephone Apparatus and Fire Alarm Apparatus.

In compiling this catalogue, QUALITY has been our first consideration, and every line is guaranteed by us, as well as the manufacturers.

Large stocks carried at each of our Houses



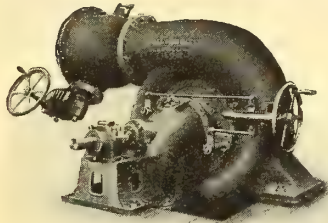
THE Northern Electric
AND MANUFACTURING CO. LIMITED



Manufacturer and Distributor of Telephone Apparatus, Electrical Supplies and Fire Alarm Apparatus for every possible need

MONTREAL TORONTO WINNIPEG REGINA EDMONTON CALGARY VANCOUVER

Water Power Plant



Type 30 Francis Turbine
1000 B.H.P. 120 Feet Fall

As supplied to Ocean Falls Pulp and Paper Co., Dryden Timber and Power Co. Expert advice at your immediate disposal for estimating purposes, etc.

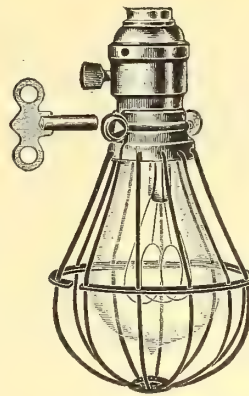
James Gordon & Company

81 and 83 Knightbridge Street, LONDON, ENGLAND.

Sole Canadian Agents

Chapman & Walker, Ltd.

69 Victoria Street, TORONTO



LOXON
LAMP GUARD
THE KEY TO SAFETY

Burned out Lamps are the only ones to be replaced when Loxon is used.

No more Lamp Theft—No more
Breakage—Fire Danger Lessened

All this made possible by **LOXON**.

Loxon locks on with a key and protects against all kinds of loss—not possible with guards fastened only with set screw or wire.

A Loxon costs no more than a lamp and saves many.

To users who will write on their letterhead, we will send **FREE SAMPLE FOR TEST**.

Carried by all Canadian Electrical Dealers.

McGILL MFG. CO.
5 OAK ST., VALPARAISO, IND.

Talk No. 1

Last month we issued our first trade announcement wherein we stated that The MAINER ELECTRIC CO., LTD. of Winnipeg, Man. were in shape for business. We also advised that Mr. R. H. Mainer, late Manager of the James Stuart Electric Co. is the head of the new organization. We omitted to state however, that we have secured the services of some well known men in the Western Electrical field, and we expect that they will be out calling on our prospective customers within a few weeks.

Every advertiser wonders what benefit he secures from his advertisements. We have already direct evidence that our friends and others must have read ours, as we are receiving very many inquiries over the mail daily. Both from our customers to be, and also from interested factories who desire live representation; and there have been some orders too. One well wisher ends his letter by saying "Glad to see you are planted right; run your new business as you did the previous one during the last five years and you can't help but succeed."

We expect to enter our permanent warehouse August 1st but in the meantime we are prepared to handle business promptly, politely and profitably. Our stock of standard electrical supplies is arriving just as fast as we can take care of it. We are out after customers new and old. Let us hear from you and see what we can do.

We will have limited space to-let for an electrical factory wishing to consign goods and be represented. Of course we supply the sales organization. Watch for our further announcement next month.

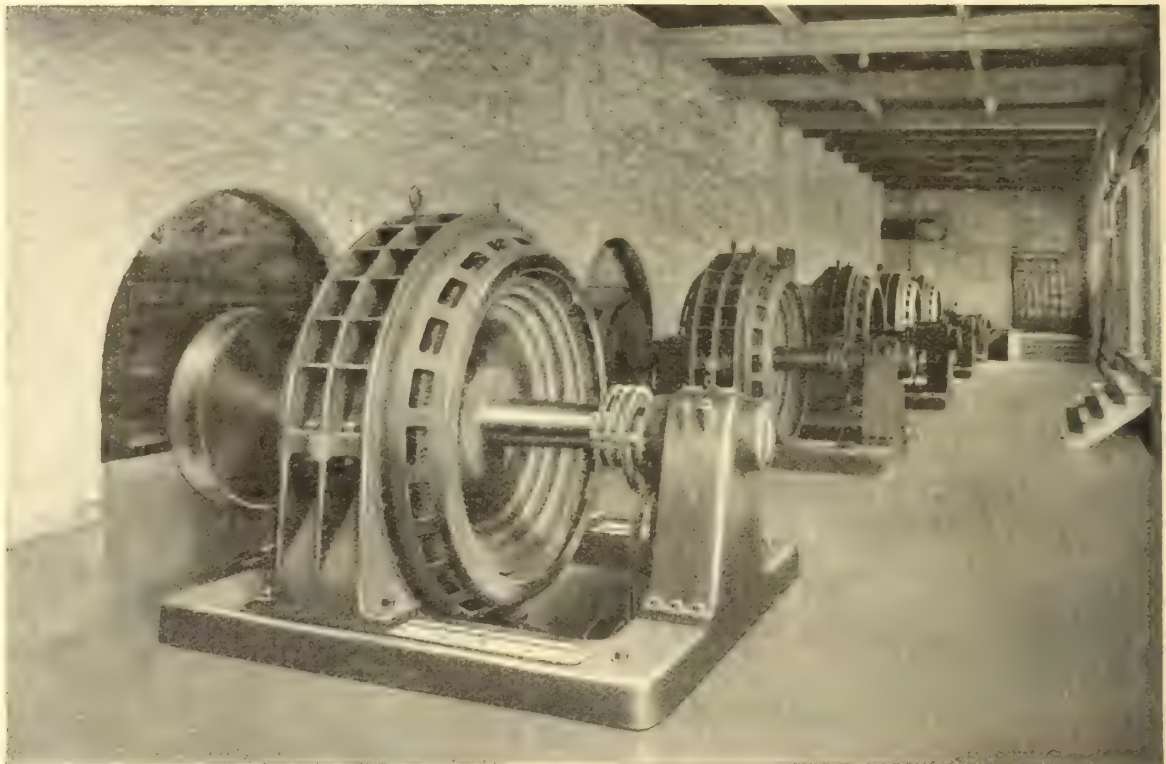
The Mainer Electric Company, Limited

302 Donalda Block, WINNIPEG, MANITOBA

Industrial Motors

DESIGNED AND BUILT

For All Purposes



Five Motors each 1200 H. P. with Flexible Couplings Driving Pulp Grinders

The wide space between bearing centres, necessary to permit lateral movement of the yoke, and the small air gap, necessary to obtain good power factor, demanded a specially strong shaft to prevent deflection due to the weight of the rotor and unbalanced magnetic attraction between rotor and stator.

Works—MONTREAL

ALLIS-CHALMERS-BULLOCK
LIMITED

MONTREAL: 612 Canadian Express Bldg.
TORONTO: 810 Traders Bank Bldg.
CALGARY

WINNIPEG: 601 Builders' Exchange Bldg.
VANCOUVER: Dominion Trust Bldg.
COBALT



No. 5749—"Midget Plug",
Composition Cap. Black por-
celain base. List price 25c.

Centralized Profits For Central Stations

CENTRAL Stations that sell Electric Fans will find Hubbell Attachment Plugs a source of substantial profit. You can make every Fan you sell, sell a Hubbell Plug.

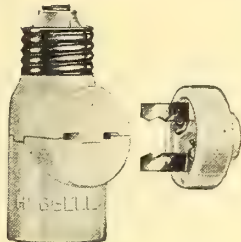
Every Hubbell Plug put into use will help your sales of current consuming devices.

Hubbell Plugs are a force to centralize three Central Station profits. You'll make good money on sales of Hubbell Plugs—on the devices with which they are used—on the current the devices consume.

Free Advertising Literature For Central Stations

If you are ready to be helped, we are ready to help you. Let us send you a supply of attractive circulars printed with your name and address. Put them out and they'll surely bring in the business. Write us today.

R. E. T. PRINGLE
MONTREAL
TORONTO
WINDSOR



Hubbell Side-outlet
Current Tap

Electrical Supplies

Street Railway Material Lighting Standards

Fibre, Pressboard, Leatheroid,
Insulating Material, "Hot
Point" Irons, Heating Appli-
ances, Fans.

"P. & S Shurlock Sockets"

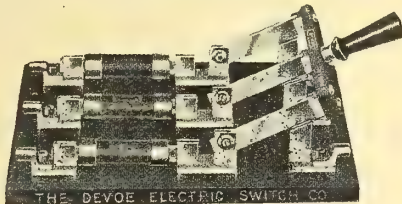
Dawson & Co'y Limited

MONTREAL :: :: WINNIPEG
Electrical Supplies and Apparatus

The Devoe Electric Switch Company

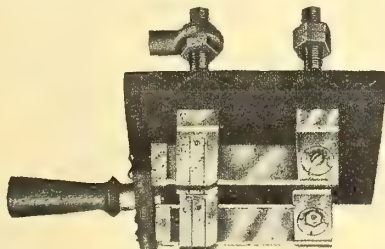
Manufacturers of

Switches, Switchboards, Panelboards, Iron Boxes and Cabinets

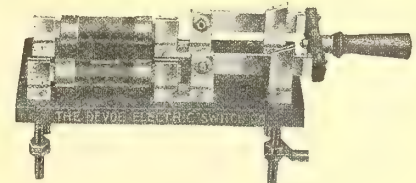


Cut No. 343.

An examination of "DEVOE" Standard Panels, Switches and Switchboards will convince you they are the best made.

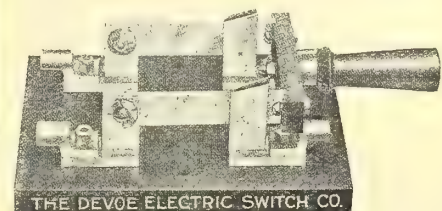


Cut No. 268.



Cut No. 205.

Every "DEVOE" product is built for efficient service under actual operating conditions.



Cut No. 205.

OFFICE and FACTORY, 157 Craig St. West, MONTREAL

Public Service Corporations

desiring to finance their needs by the sale of Bonds are requested to communicate with us.

We deal extensively in the bonds of Hydro-Electric Power Companies, Electric Railways, Gas Companies and Electric Lighting Companies which meet our requirements.

E. H. Rollins & Sons

Investment Bonds
200 Devonshire St.
Boston, Mass., U. S. A.

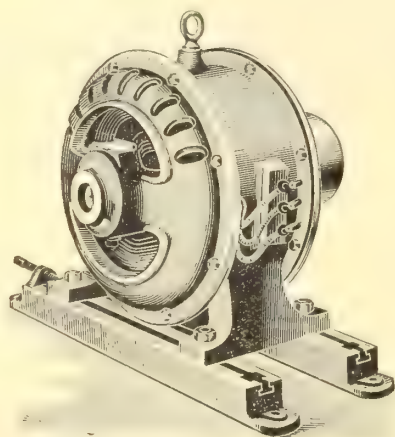
**We Purchase Outright
entire issues of bonds
on steam and elec-
tric railroad, gas,
electric and
hydro-electric
properties.**

N. W. HARRIS & CO.

Established 1882
Incorporated 1911
35 Federal Street, Boston, U.S.A.

Use Good Motors

to drive your factory



Such as are manufactured by

**Toronto & Hamilton
Electric Company**
Hamilton, Ontario

HAVE YOU ANY REPAIRS? WRITE US.

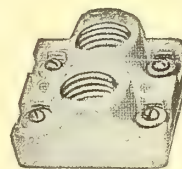
Electrical Supplies of every Description

A few of our specialties:

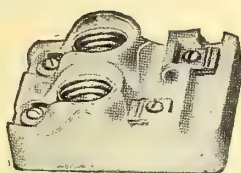
Moloney High Efficiency Transformers
Carbon and Tungsten Lamps
Rigid and Flexible Conduit
Condulets

Large stock ; prompt shipments.
Write for new and complete catalogue No. 3.

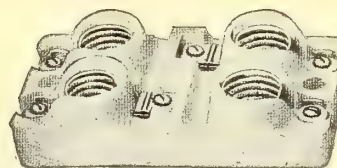
**Central Electric & School
Supply Co., Limited**
36 Adelaide St. West, Toronto

No. 8020 ($\frac{1}{4}$ Full Size)No. 62965 ($\frac{1}{4}$ Full Size)

EDISON PLUG CUTOUTS AND ENTRANCE SWITCHES

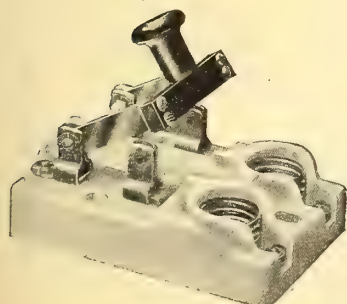
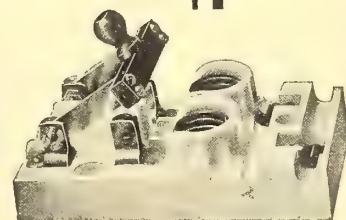
No. 61935 ($\frac{1}{4}$ Full Size)

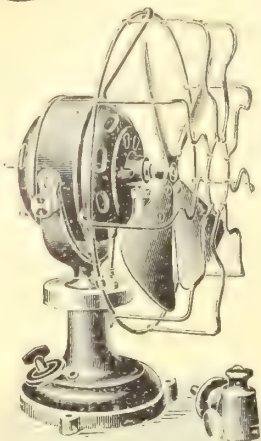
Order
Through Your
Jobber

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The Duncan Electric Company
Limited
MONTREAL, QUE.

Makers of Electrical Supplies

No. 1695 ($\frac{1}{4}$ Full Size)No. 1851 ($\frac{1}{4}$ Full Size)

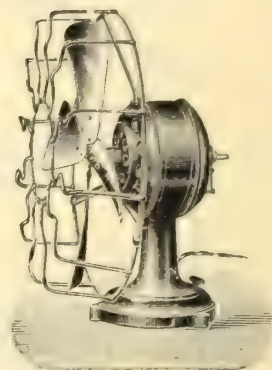


MONEY

IN



FANS



Write for our Stock and Price Lists. Orders shipped immediately from Stock for both A. C. and D. C. Fans.

Chapman & Walker, Limited

Head Office : 69 Victoria Street, TORONTO, ONT.



MONTREAL, QUE.
406 407 St. Nicholas Bldg.

Branch Offices :
WINNIPEG
305 McGreevy Block
VANCOUVER
Imperial Block

PORCUPINE
J. P. Bartleman

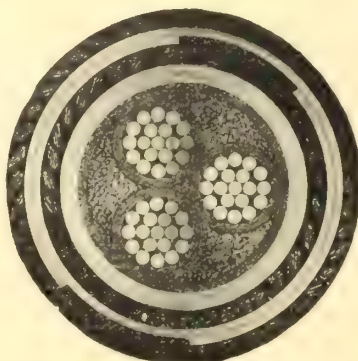


V. I. R. Cables

Wire, Flexible

Paper Insulated
Lead Covered
Cables

Telephone Cables



.075 sq. in. three core, circular
lead covered, steel tape
armoured cable

MONTREAL AGENTS:

Alexander Macpherson & Son,
Montreal, Que.

Vulcanized Bitumen Cables

Transmission
Lines

Trailing Cables

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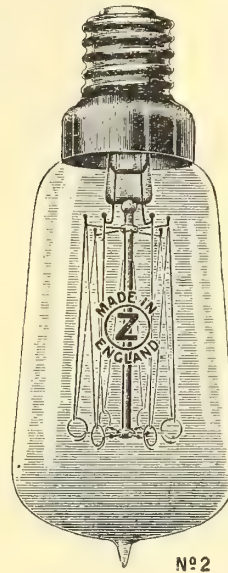
Chapman & Walker, Limited
69 Victoria Street
Toronto, Ont.

W. T. Henley's Telegraph Works Co. Limited

Contracts taken for complete Cable Systems installed



Guaranteed Non-Blackening



Look for the Chemical on the Stem

"Z" Lamps are the only metal filament lamps which fully meet the requirements of general every day use. Write for Illustrated Booklet and Stock List. Always over 100,000 Carbon and Tungsten Lamps in stock or in transit.

Prompt delivery assured

Chapman & Walker

ENGINEERS AND CONTRACTORS

Head Office: 69 Victoria Street, Toronto, Ont.



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Branch Office
406-407 St. Nicholas Bldg.

WINNIPEG
150 Princess St.

VANCOUVER
Branch Office
Imperial Block

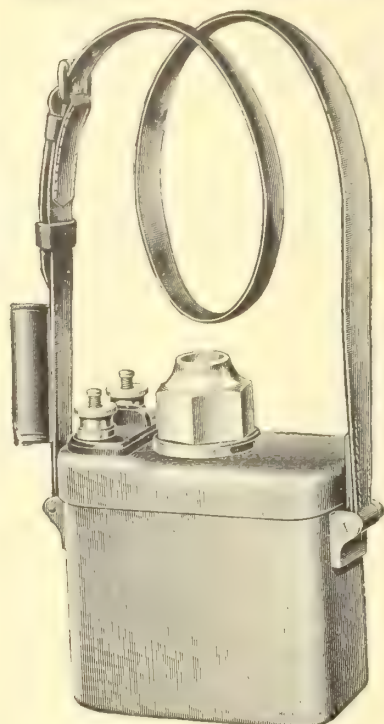
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General Supplies, Ltd.
1233 Second S., E.

PORCUPINE
J. P. Bartleman



Stock Carried in Montreal, Toronto, Winnipeg, Calgary and Vancouver

ELECTRIC BLASTING MACHINE



No. C 2602 (Brass Case)
To Fire 10 Shots.
With Detachable Handle.

STERLING TELEPHONES BRITISH MADE

AGENTS (With Stock.)

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Winnipeg.

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SASKATCHEWAN:—Northwestern Electric, Ltd.,
Regina.

BRITISH COLUMBIA:—Walker & Ure, 527 Duns-
muir St., Vancouver.

ALBERTA:—General Supplies, Ltd., 1233, 2nd Street
East, Calgary.

QUEBEC:—stocks kept by Dawson & Co. Ltd.,
Montreal. Munderloh & Co., Montreal.
Mechanics Supply Co., St. Paul, Que-
bec, (Que.)

NOVA SCOTIA:—stocks kept by J. Starr,
Son & Co., Ltd., Halifax.

Heating With Exhaust Steam

The Most Profitable Load an Engine Carries

Many of you are manufacturing heat in the form of steam, but what becomes of it? You are simply converting 10 to 14 per cent. of it into mechanical energy in the form of electricity, and throwing the balance away, either into the atmosphere or into the condenser.

The plant which operates non-condensing may have 10 per cent. heat efficiency and the condensing plant a possible 14 per cent. conversion.

Why Not Sell the Larger Amount of the Otherwise Lost Energy

You can get a price for it which will pay the total fuel bill of the plant, including also such other expenses as water, oil, etc.

CAN IT BE DONE? YES!

Others are not only doing that very thing, but are also earning interest and depreciation on the cost of the steam installation.

*We not only Make Reports and Build Central Station Plants,
but Solicit Business and Manage Such Plants, if Required.*

Why Not Take Advantage of Our Experience?

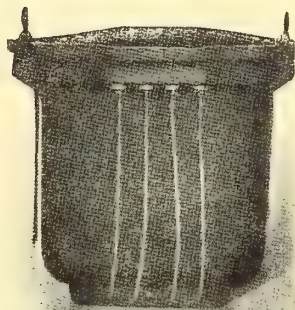
Central Station Heating & Construction Co.

714 Ellicott Square, BUFFALO, N. Y.

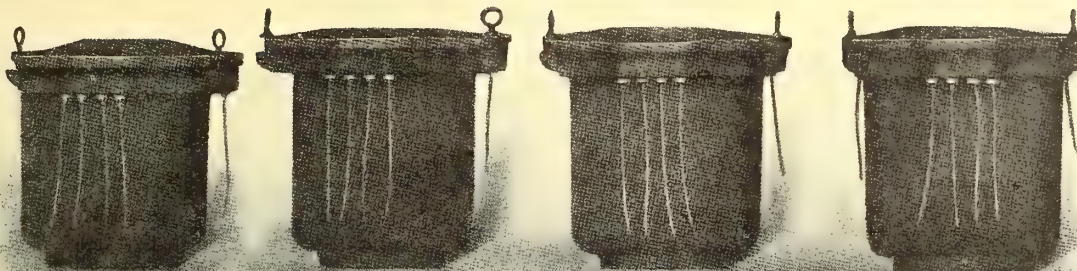
Canadian Office: W. E. SKINNER LIMITED, Somerset Building, WINNIPEG

PACKARD

Distributing



Transformers



Light



Power

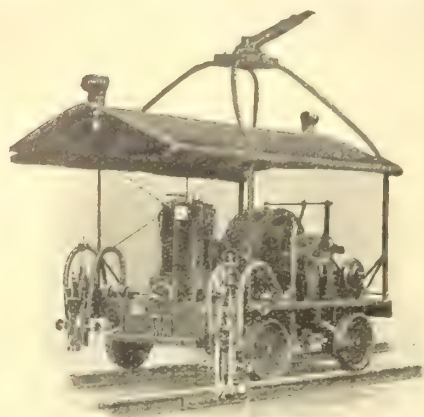
The Packard Electric Company, Limited

Factory: ST. CATHARINES

General Sales Office
901-902 Traders Bank Building,
TORONTO

N. W. Office and Warehouse
WINNIPEG

Electric Weld Rail Bonds



The conductivity of Bonds installed by our process can never be impaired by moisture or corrosion.

When once installed, they are on to stay and cannot be removed without actual mutilation and considerable hard work.

Write for Booklet

The

Electric Railway Improvement Co.

Office and Works, 6005 Carnegie Avenue
CLEVELAND

Dealers in the West!

Sell the
Made-in-Winnipeg

X CELL DRY BATTERY



Western Canada knows and prefers X CELLS. Our No. 8 for heavy duty has become the standard throughout the West. If your battery sales are weak, connect up with the vitalizing force of X CELLS and make that department worth while.

Let us put you in touch with the nearest jobber

Canadian Carbon Company
of Winnipeg, Limited

Bury and Irish Ave., WINNIPEG

E. W. HANNA, President and Managing Director

FERRANTI LIMITED

ELECTRICAL and
GENERAL ENGINEERS

Manufacturers
of

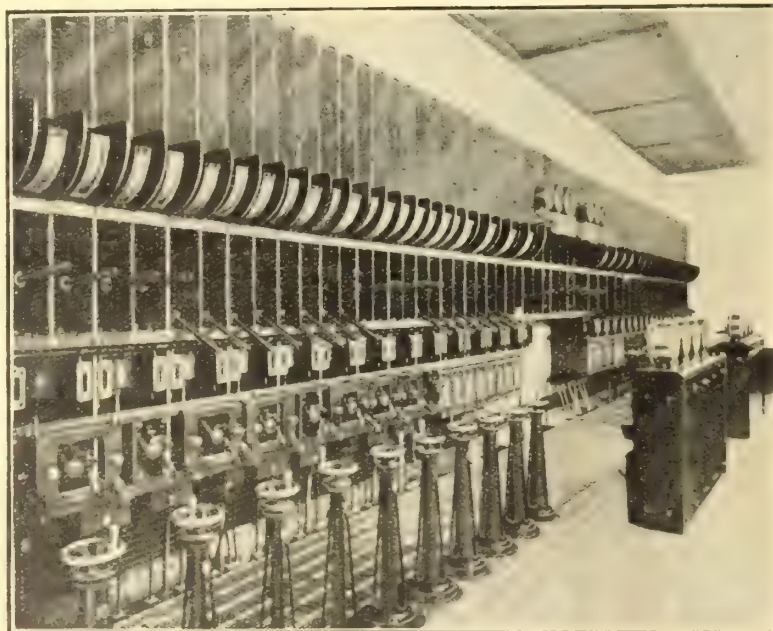
Complete
Switchboards
D. C. & A. C. up
to 60,000 Volts.

Transformers

Auto Starters

Switches

Circuit
Breakers, etc.



Reliable
Operation

Substantial
Construction

combined with

Accuracy
and
High Class
Finish

Canadian Representative

G. C. ROYCE — West Toronto, Ontario

If you are in the market for any kind of electrical equipment—send us your specifications and let us quote you.

Review of Reviews
Literary Digest
Motor
Vogue
Journal of Am. Medical Assn.
Theatre
Cosmopolitan
Scribner's
Presto
Popular Electricity
Therapeutic Gazette
Dry Goods Economist
Central Station
Cement World
Black Diamond
Automobile
Brewer & Maltster
Electrical Review
Motor Car

Brick
Electrical Merchandise
American Journal of Surgery
National Laundry Journal
Collier's
Life
Outlook
Everybody's
Electrical Record
Grocery World
Electrical News
Motor Print
Bakers' Review
Iron Age
Electrical World
Motor Age

Over 13,000,000 People Will Read About Electric Vehicle Superiority Each Month

35 national magazines and trade journals will tell the Electric Vehicle story every month to over 13 million readers.

Think of that, Mr. Central Station Manager! These 35 messengers will bring home every point of Electric Vehicle superiority to millions of people — many of them right in your own territory — in a way *they can't overlook*.

The sale of Electric Vehicles — both pleasure and commercial — is growing *steadily*. This campaign of persistent advertising is going to quicken the step of the march forward.

Every Central Station Should Take An Active Interest in This Campaign

This campaign of education has a direct bearing on *your* business. The charging of Electric Vehicles will lessen the drain of your "valley load" and make off-peak hours far more profitable.

We want to tell you how you can link up this nation-wide campaign to *your* Central Station and share in the assured results. You can do this with but little expense on your part. Why not write for further information today?

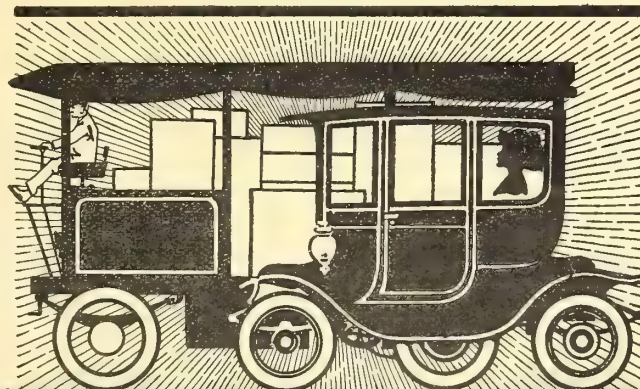
ELECTRIC VEHICLE ASSOCIATION OF AMERICA

BOSTON

NEW YORK: 124 W. 42nd St.

13

CHICAGO



Electric Glass Shades !

Selected Designs
Rich, Dainty
and
Artistic at Close
Prices.



X 167

Green Cones,
Half Shades,
Cut Star Balls
Billiard Shades
etc. !!!



X 175

Silk Flex
Silk Counter-
weight Cord
Shock Absorbers



X 190



X 193

Two and Three
Way, Tumbler
Switches
Counterweights

PROMPT SHIPMENTS FROM STOCK

The Canadian Tungsten Lamp Company

Lighting Experts

Limited

HAMILTON

- - -

ONTARIO

DRAWN-WIRE

KOLLOID WOLFRAM

TUNGSTEN LAMPS

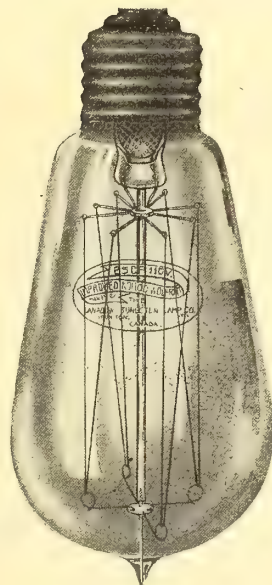
MANUFACTURED IN HAMILTON BY SKILLED CANADIAN WORKPEOPLE

The restrictions placed on the importation of inferior foreign lamps has reduced our selling cost—

So we offer our Customers

Another Substantial Reduction in Price

Our Improved Methods
Ensure Increased Efficiency,
Additional Stability and Longer Life.



Also Automobile Lamps
in Various Candle Powers,
Bases and Voltages.

Prices on Application

The Canadian Tungsten Lamp Company

Lighting Experts

Limited

HAMILTON

ONTARIO

BRANCHES: Montreal—30 St. Dizier St., J. W. Moncur, Manager.

Winnipeg—56 Albert St., A. L. Woolf, Manager.

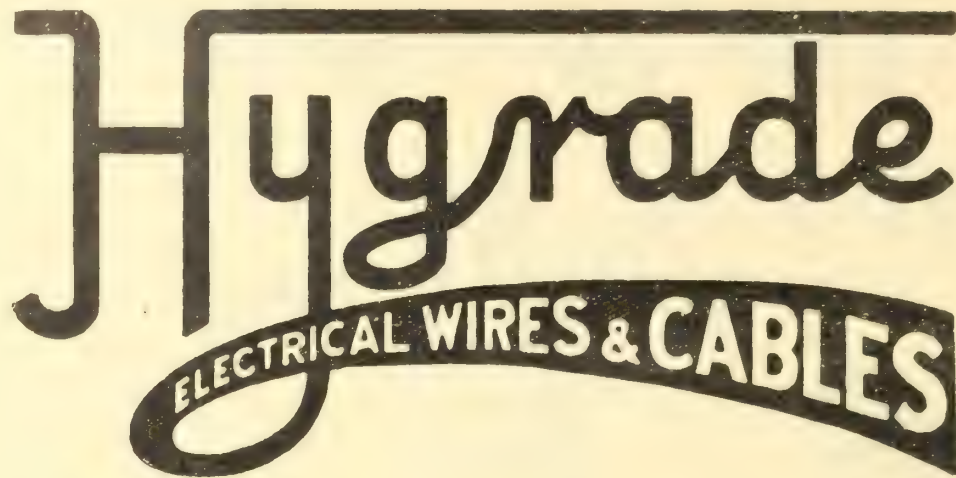
Toronto—342 Yonge St., L. E. Harp, Manager.

AGENCIES: Vancouver—606 Granville St.

Newfoundland—St. Johns, Walter Clouston

New Brunswick—St. John, O. H. Warwick Co. Limited. Victoria, B. C.—911 Government St.

Quebec, P. Q.—Mechanics Supply Company.



Copper Aluminum Iron

Weatherproof Insulated and Bare

For
Telegraph, Telephone, Lighting
Power and Street Railway Circuits

Galvanized Steel Strand for Guys

Canada Wire & Cable Co.

Limited

Eastern Sales Office and Warehouse
Roper Clarke & Co., Limited
422 Coristine Building, MONTREAL

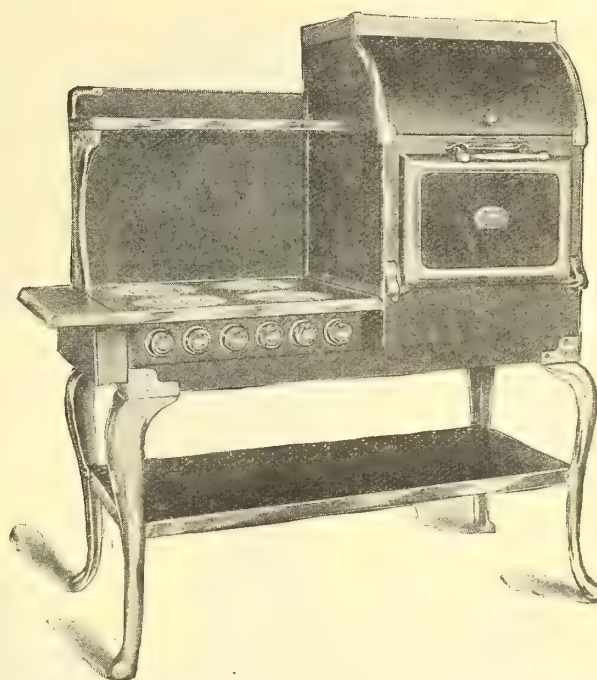
Head Office and Factory
1160-1170 Dundas Street
TORONTO

One Central Station Has Installed 157 Hughes Electric Ranges

and has built up a total connected stove load of 500 K. W. An increase of only 80 K. W. in transformer capacity was necessary to handle this load, as experience has shown that stoves add little to the evening peak.

The average monthly cost of current per consumer and including hotels, restaurants, boarding houses, etc., has never exceeded \$3.09.

This is the biggest electric range installation in the world. If you'd like to learn more about it, just write to



Hughes Electric Heating Company

226-8 W. Superior St.

Chicago, Ill.

Can be procured in Canada through either
Roper Clarke & Co., 422 Coristine Bldg., Montreal, Que. or
The James Stuart Electrical Co., Winnipeg, Man.



NEWTYPE BERGMANN LAMPS

(Tungsten Filament)

The Unbreakable Kind

Are Now Ready for Delivery

We guarantee delivery to you in good condition

EXCLUSIVE CANADIAN DISTRIBUTORS

P. H. KLEIN, Jr., CO. 329 CRAIG STREET WEST
MONTREAL, P. Q.

LIVE AGENTS WANTED ALL OVER CANADA

Figure Out Your Transformer Cost

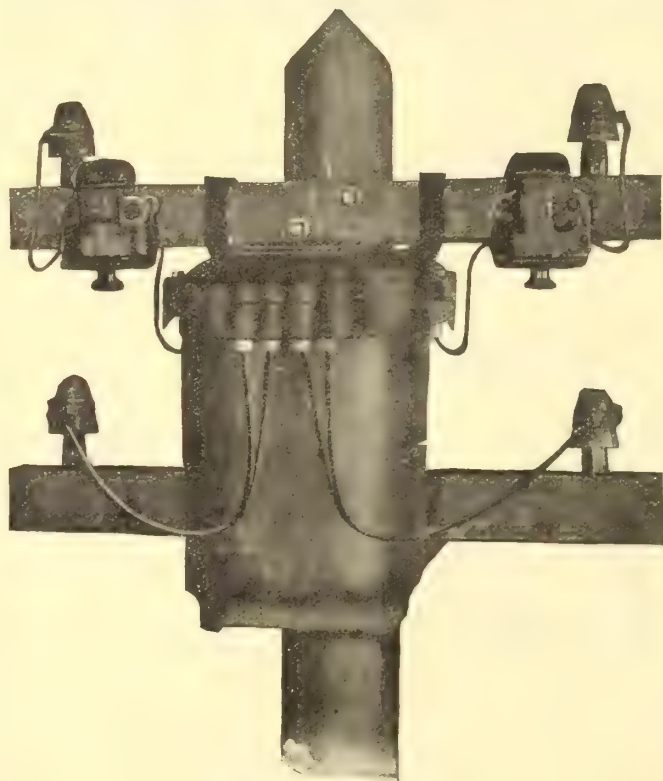


Not just the initial outlay but the maintenance cost—that is the REAL cost. The working expense of the transformer installation is a big item in any power line.

Core and copper loss is going on all the time—day and night—so is the consumption of energy in the transformation of current.

This will be a perpetual waste with any ordinary transformer—a waste you will not be able to trace and a loss you will not be able to calculate—but a waste that is eating up profits all the time.

This is surely a case where the “ordinary good” is not good enough—where only the best will suffice.



MOLONEY HIGH EFFICIENCY TRANSFORMERS

effect a clear saving of 20% over the operation of any “ordinary good” transformers. They decrease the coal bills, lessen interruption of service and increase dividends wherever installed.

Manufactured of the very best Silicon Alloy Steel, they ensure long life and low core loss. The low Temperature Rise prevents deterioration of insulation and therefore removes the limitation of output.

Moloney Transformers are the only ones for real, high, all day efficiency—they will save in the end. Send for our catalog—it is worth your while.

Canadian Moloney Electric Co.

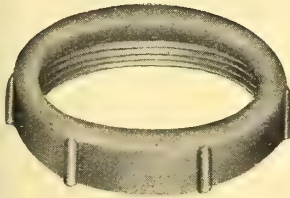
Office and Works: WINDSOR, ONT.

Limited

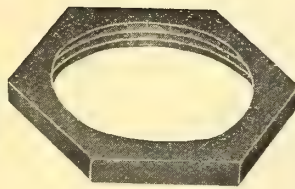
DISTRICT OFFICES:

J. D. Lachapelle, 512 Canadian Express Bldg., Montreal, Que. A. Ross Osborne, 616 Continental Life Bldg., Toronto, Ont.
Hinton Electric Company, 606 Granville Street, Vancouver, B.C.
Full stock carried in Winnipeg by the James Stuart Electric Co.

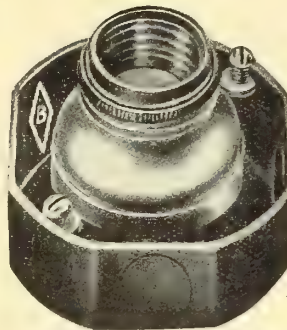
Electrical Supplies



1 1/4" Bushing



1 1/4" Locknut



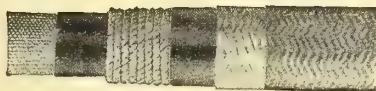
No. 6350—Box and Receptacle



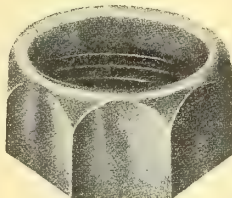
No. 1915—Box and No. 3719—Cover



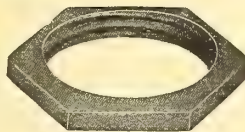
1455—Reversible Guard



Alphaduct



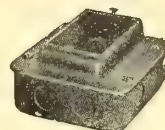
1/2" Bushing



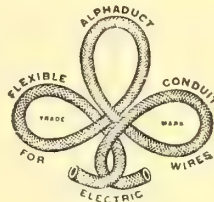
1/2" Locknut



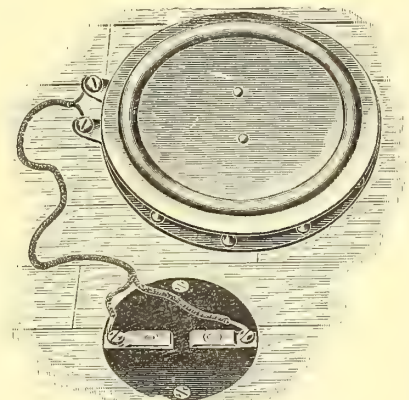
1/2 to 1" Grounding Clamp

81 A 3/8
Fixture, Stem

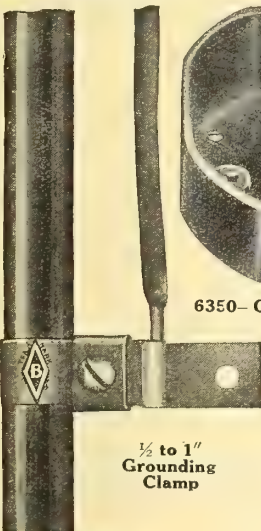
No. 1915—Switch Box



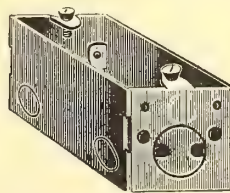
Alphaduct 1/4"



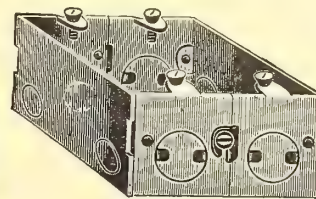
1150—Floor Tread

1/2 to 1"
Grounding
Clamp

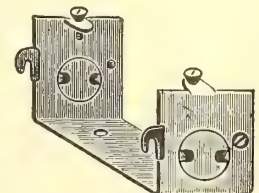
6350—Outlet or Junction Box



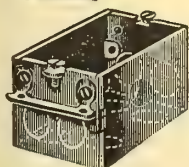
170—Comb Switch Box



172—2 Gang



171—Spacer



C.C.S. I. Switch Box

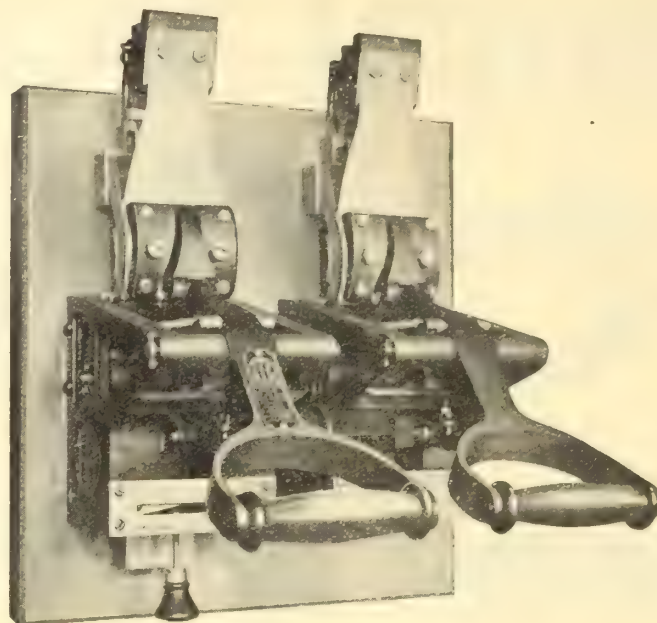
Electrical Fittings Co. Limited

70 King Street West, TORONTO, Canada

British Columbia Agents, Cope & Son Ltd., 132 Water St., Vancouver, B. C.

"Made in Canada"

Write for Catalogue No. 3. If your Jobber cannot supply, write us.



Consideration of Space Economy

is often of great importance in the design of the switchboard, and this point we have borne in mind in the development of our apparatus aiming to produce for each class of service the Circuit Breaker best adapted to the end in view, embodied in the smallest dimensions consistent with satisfactory performance.

The I-T-E Dublarm

Circuit Breaker, N-X Type, illustrated at the top of the page is a striking instance of this development. It is widely used for the protection of direct current lighting and power feeders of 250 volts or less, and is also well adapted for the protection of individual motors.

THE CUTTER COMPANY, Main Office and Factory PHILADELPHIA

W. C. Jessup, 120 Liberty Street, New York City.
H. F. Darby, Jr., 1501 Monadnock Block, Chicago, Ill.
H. W. MacVaugh, 1122 Park Building, Pittsburgh, Pa.
Thos. E. Beasley, 531 Ellicott Square, Buffalo, N.Y.
C. E. Wise, 427 Ford Building, Detroit, Mich.
Eccles & Smith Co., 71 First Street, San Francisco, Cal.
Eccles & Smith Co., 521 S. Los Angeles St., Los Angeles, Cal.
Eccles & Smith Co., 68 First Street, Portland, Ore.
Electric Manufacturers' Sales Co., Tramway Bldg., Denver, Col.
I-T-E Electric Co., 72 Finsbury Pavement E.C., London, Eng.

Your Easiest Sellers

X-Ray Window Reflectors

Go to Mr. Merchant and say:

"Your show windows pull business. The brighter they are lighted, the more people will stop and look at your offers.

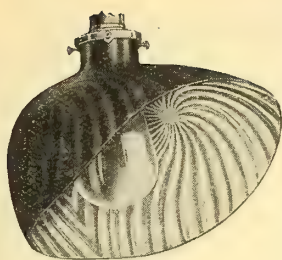
These X-Ray Reflectors were designed to *properly* light show windows. They are the most powerful made. They will light your windows *more* brilliantly than they are now lighted, *not* increasing your light bills one penny. They have done this more than ten years in Chicago's largest stores. They are the biggest paying *small* investment you can make.

You would be *eager* to buy that which would make *more* folks look at the values *your* windows offered! You're no different from other men in *that* respect.

Write us for catalogs, prices, discounts and the name of your nearest jobber.

National X-Ray Reflector Company
214 Jackson Bvd., Chicago, Ill.

who originated the EYE COMFORT System of Indirect Illumination.



SCOOP
For Ordinary Windows



HELMET
For High Windows

Economy Renewable Cartridge Fuses

(Now Made in Canada)

Patents have been granted on the **Economy Renewable Fuses** for Canada and Great Britain.

In order to meet the demand and furnish direct to the Canadian trade The Economy Fuse and Manufacturing Company of Canada has been organized to manufacture these fuses in this country.

Economy Fuses are guaranteed to operate according to ratings, and to meet specifications of the National Board of Fire Underwriters.

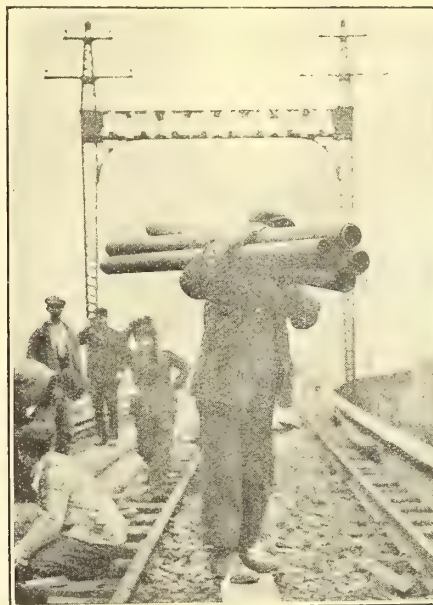
Can be easily and cheaply renewed without returning to the factory. No soldered connections. Will save 80 per cent. of annual fuse expense. The secret of success is in the link renewal.

"LOOK FOR THE GREY SHELL"

We would like to establish a few exclusive agencies.

Economy Fuse & Manufacturing Company of Canada
Bridgeburg, Ont.

Longer Life at Lower Cost



For Satisfying Results, in Underground Subway and Power House Construction specify American Bitumized Fiber Conduit. Strongest and most durable conduit made.

Electrolysis proof—water-proof—gas proof

Write for Booklet and General Information

American Conduit Co.
140 Nassau St., New York - East Chicago, Indiana



H. WEIDMANN, RAPPERSWIL, SWITZERLAND

Specialist in the manufacture of

PRESSPAN—(Pressboard)

BEST QUALITY, PROVED BY REPEATED TESTS

Sheets in thickness from 0.1 mm. upwards.

Endless Rolls and Strips 0.1 to 1 mm. thickness.

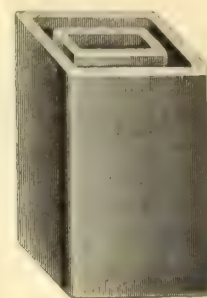
BLACK PRESSPAN IN SHEETS, ROLLS AND STRIPS

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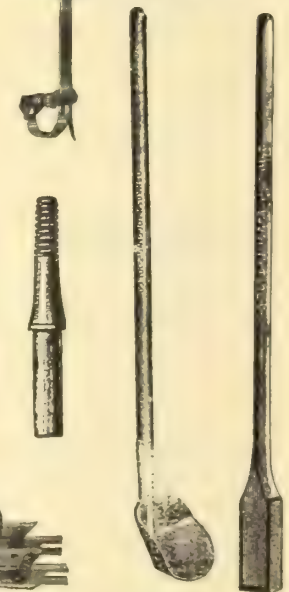
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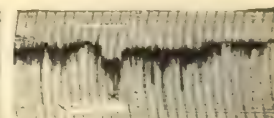
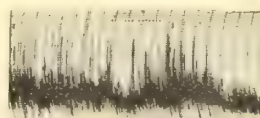
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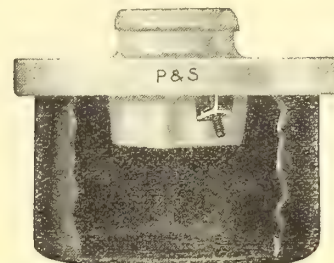
The illustration above shows P & S 42 mounted on one of the standard 4-inch outlet boxes.



The illustration above shows P & S 10 mounted on one of the standard 4-inch outlet boxes.



The illustration above shows P & S 78 mounted on one of the standard 4-inch outlet boxes.



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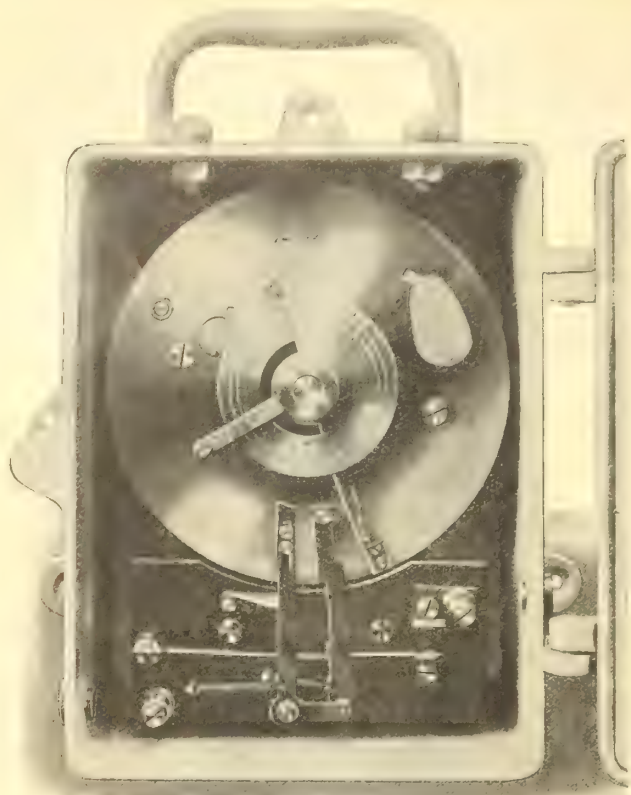
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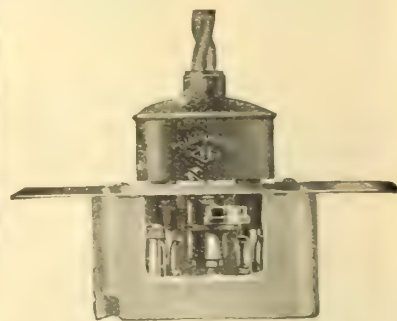
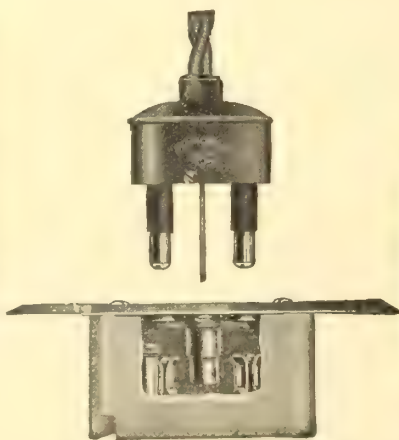
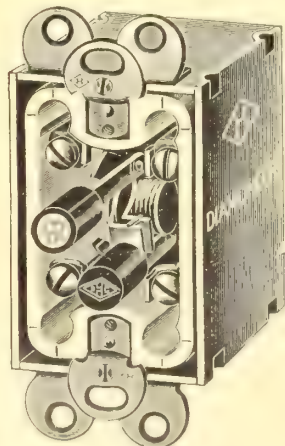
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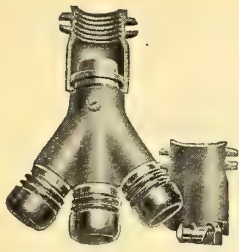
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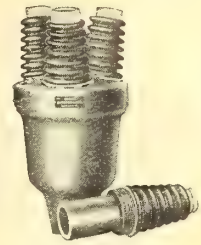
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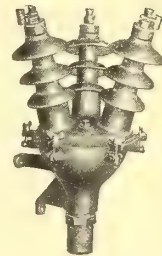
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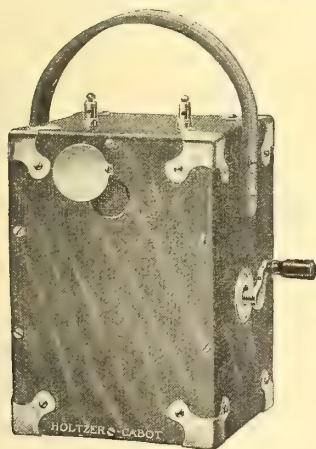


□ The cut shows the type of flexible "A" frames recently erected for a 34 mile line from St. Catharines to Hamilton. These are 47 feet high and 9 feet wide at the ground. Placed approximately 400 feet apart along the line.

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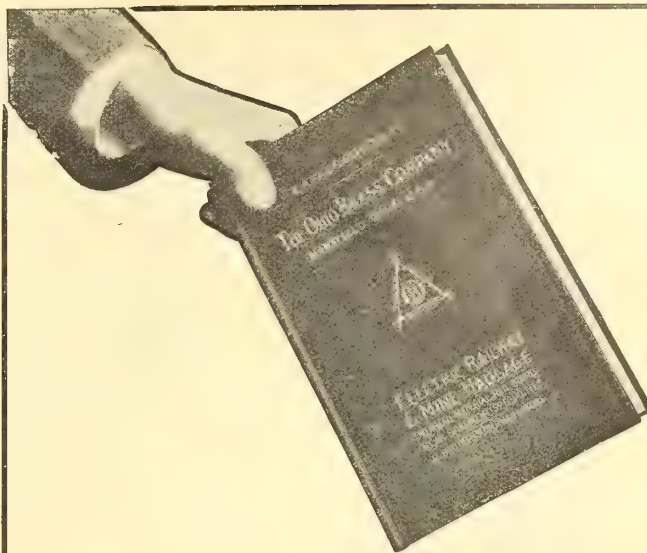
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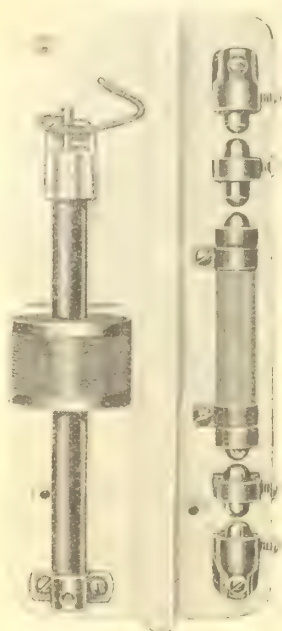
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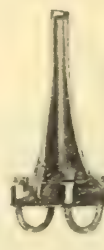
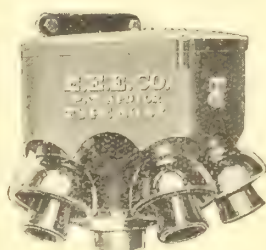
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Generation, Transmission and Application of Electricity

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Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Vol. 21

Toronto, August, 1912

No. 8

Auxiliary Plants

Two events of unusual engineering importance have marked the progress of the past month—the repeated failure of the transmission line of one of our largest operating companies and the report to the city of Kingston on her power problems, and though the former has been the source of rather more daily newspaper elucidation it is doubtful if either can be said to take precedence in importance over the other in the lessons that may be learned from them. It has long been recognized by the engineering profession that a single source of supply of power is pretty sure, sooner or later, to prove inadequate, and most of our larger companies are gradually increasing their auxiliary steam powers. That this practice must be pursued to a still greater degree and that the auxiliary equipment must be kept in absolute readiness for immediate action is now more forcibly evident than ever. The argument that has always been advanced against the installation and operation of auxiliary plants has been the heavy cost. Some way or other we have got into the way of thinking that electric energy can be developed from water power much more cheaply than from steam, which is not the case, except under the most favorable conditions. This is evidenced by the fact that the rates given in numerous towns and cities throughout this continent where power is generated by steam are quite as favorable as where water power is available. It is further shown in a remarkable degree by the recent action of a private company in installing extra steam equipment right under the nose of a big water power and during the past month has again been evidenced by the report of engineer Kelsch, who advises Kingston city to accept neither the rates of the Ontario Hydro nor of the

Electric Power Company, but to extend their steam plant.

Many other instances might be cited but the case seems proven that with modern equipment the steam plant is, except under the most unusual circumstances, now in a position to compete with water power. Of course, this does not mean steam equipment of ten years ago, for the improvement in over-all efficiency of steam and other prime moving equipment during the last decade is little short of marvellous. The necessity for auxiliary plants as well as their competitive efficiency has therefore been shown by recent events.

About Experts

At the risk of arousing criticism in certain quarters we venture to protest against the all too common Canadian custom, as soon as anything goes wrong with any of our equipment of any kind whatsoever, of rushing headlong after the "best American (meaning U.S.) experts." This is frequently the case when we have as good men, often better, right at home. Indeed, looking back over our experiences with U. S. so-called experts—financial, engineering, operating or otherwise—it is difficult to see, except in isolated cases, where any advantages have been gained (and there are many cases of actual disadvantages) by this everlasting agitation for the "best American"—unless it be to offset the mere lack of prestige which the prophet hath always suffered in his own country.

A case in point is that thrust upon us during the last few days in connection with the Toronto Power Company's line. Eager approval was expressed on all sides (pages) when it was learned that a noted New York engineer was being brought to the scene of the trouble—an approval that was quite oblivious to the fact that the same engineer was, if anybody was, the cause of the trouble, he having designed and built the faulty line in the first place. To add insult to injury it appears that this engineer has by his later actions deliberately let the impression go abroad that the chief engineer of the Toronto Power Company is at fault, when as a matter of fact, Boyd had no more to do with the construction of the faulty equipment than the reader or the writer of this article. On the contrary it would appear that the chief engineer deserves nothing but the highest praise for the successful operation, over a number of years, of a line of which he must have recognized the weaknesses more than anyone else could. Be that as it may, the reputation of the "best American expert" must be safeguarded and Boyd, an operating engineer without a peer on the continent, a member, "honoris causa," of the Institution of Electrical Engineers of Great Britain, is made the butt of the great expert's importunity. We hope this is a matter that will receive instant adjustment by Sir. Wm. Mackenzie and his associates and we hope also Canadians will not need many more such unfortunate experiences before we awake to the fact that we breed as good men within our own borders as may be found in the whole world. What we don't know we will try to learn, but we must gradually get away from our childish traditions of believing the other fellow knows a lot more than we do simply because he says so in a loud voice.

Resignation of P. W. Sothman

Mr. P. W. Sothman, for several years chief engineer for the Hydro-electric Power Commission of Ontario, having completed the work for which he was engaged and specially fitted, has resigned, leaving behind him, we believe, a monument of the finest piece of work in transmission line construction the world has yet seen. It was a fortunate thing for Ontario that choice fell on Mr. Sothman for more reasons than one. First of all, the weakest link in all electric systems operating over large areas is invariably the high tension transmission and to strengthen this link meant mak-

me the whole claim just that much stronger. But scarcely less important than this was the fact that the undertaking was a political one and as such was apt to become the prey of the office seeker and grafter of the modern aggressive type to an extent that would have ruined the chances of success of the enterprise.

But the exigencies of party politics no more influenced the honest Dane than ice and snow, winter and summer, lightnings and tempests affect his transmission line, and whatever of success may be judged to have attended up to the present time the so-called Beck policy must be credited almost as much to the outstanding personal characteristics of the chief engineer himself as to his engineering ability. It is quite within the range of possibility that the aforesaid exigencies have been the indirect cause of the resignation we all so much regret, but we are pleased to hear that Sothman is for all time a Canadian, and those of us who live in Toronto are to be congratulated that he will make that city his headquarters. For the work he has done and the way he has done it the hearty good wishes of the profession go with him and the hope that he will continue the same policy in the years to come.

The Modern Distribution System

We print elsewhere in this issue a paper on distribution layout by Mr. S. Bingham Hood, which is full of helpful suggestions for many smaller operating companies who may not have had the benefit of as wide an experience as has been gained by the writer of this article. The distribution system of the T. E. L. Company has undergone something of a transformation during the past year and now stands in an enviable position as regards good regulation and ability to deliver continuous and efficient service. For this fortunate condition of affairs the company is in no small measure indebted to the writer of this paper, who has worked directly with chief engineer Boyd, and given invaluable aid in formulating a comprehensive policy designed to serve greater Toronto for its combined railway, light and power requirements. In brief, the plan consists in serving the city from numerous judiciously placed substations fed in as far as it is possible from different primaries. From the substations the secondaries go out forming a complete and inter-connected net work covering the city, any section of which in case of trouble on a primary, may be fed from any other secondary section. This is in distinct contrast to the ordinary plan of looping the primaries so generally in vogue under similar circumstances, possessing the advantage at first sight of removing many high tension wires from the city streets.

Another important item emphasized in the distribution scheme, as outlined in this paper, is the growing use of single-phase current for small motors, the distribution of single phase being more economical under average conditions and the present-day efficiency of small single-phase motors, making this type not only possible but desirable. Further hints of a kind learned by experience and not to be found in books, will make this paper worth careful study by every distribution engineer.

Not So in Canada

The Massachusetts Gas and Electric Light Commission has issued a decision refusing to permit the Municipal Light Board of the town of Groton to sell electrical energy below cost, as petitioned by the municipality in a formal communication addressed to the commission following a recent town meeting. The commission gave a hearing at Groton a few weeks ago, at which it developed that the average cost to the town for the year ended March 1, 1912, was 16.43 cents

per kw.h., including operating expenses, interest on the investment at $3\frac{3}{8}$ per cent. and depreciation at 5 per cent. The town desired to sell energy at 12 cents per kw.h. for commercial lighting, with a probable discount of 10 per cent., making the anticipated net price 10.8 cents.

In dismissing the petition the board said in part: "It is obvious from these figures that the cost to the town of the electricity supplied by it, has been more than 12 cents per kw.h. A supply to private consumers for less than cost compels all other taxpayers, many of whom may be unable to obtain the service for their own use, to pay for the special advantages enjoyed by a few."

Will Extend to Barrie

The Hydro-electric Power Commission of Ontario has decided to spend some \$200,000 on a distribution system to supply Collingwood, Barrie, Coldwater, Elmvale, Stayner and other smaller places in this area. Power will be purchased from the Simcoe Railway & Power Company, who have recently completed the installation of a modern plant on the Severn River at the Big Chute. This plant is designed for five units of 900 kv.a. capacity each, three of which are already in operation. Tenders are being called for the duplication of the existing transmission line to Waubashene, which will be 4/0 aluminium carried on a wooden pole line. At this point the commission takes charge. Generation is at 2200 volts, which is stepped up in the company's station to 25,000. This is also the pressure at which it will be distributed by the Commission. Step-down sub-stations will be erected at the towns mentioned above. Power is already delivered by this company to Midland and Orillia, the latter town being served over their own transmission line for the greater part of the way.

Kingston Will Use Steam

Following the report of Consulting Engineer R. S. Kelsch on the power situation in Kingston, in which he advised against the acceptance of either the Hydro-electric Commission's or the Electric Power Company's offer the city contemplate making the following changes in the local plant:—to install one 500 kw. steam turbo unit, or one vertical compound engine, direct connected to a 500 kw. generator; the new electrical apparatus to be alternating current, 3-phase, 60 cycles, 2200 volts. This apparatus will be complete with condenser, piping, etc. They also figure on installing from 200 to 400 h.p. in boiler capacity, a new feeder pump, switchboards, etc., and a new building will be constructed at an approximate expenditure of \$50,000. Specifications covering the above apparatus, are in the hands of the contractors. The work will be in charge of Mr. C. C. Folger, general manager of the Light, Heat, Power and Water Departments.

Canadian-Niagara Power Extensions

Work is still under way at Niagara Falls, Ont., on the completion of the superstructure of the power house of the Canadian-Niagara Power Company, and the installation of one 12,500 h.p. unit, which will be the 7th to be placed in operation. It is expected that work on this unit will be completed before the end of the current year. The report that four additional units will be added to this plant immediately, is premature, although, of course, the plans call for this number ultimately.

The Peck Electric Company, manufacturers of Electric Vehicles, Toronto, have recently purchased 25 sets, 42 in a set, of type T. H. Vehicle Batteries from the Gould Storage Battery Company.

The City of Berlin

Canada's newest city is early demonstrating its determination to live up to its recently accepted obligations and has placed an order for a number of Jandus Pressed Steel Luxolabra which will place their standard of street illumination in the same class with the best of our other well-lighted cities. Along the main street three and five-light standards will be placed opposite one another on both sides of the street at intervals of 84 feet approximately. These will carry four 100-watt and one 150-watt lamps, fed by underground wires in fibre conduit placed 18 inches below the surface. All other poles will be removed from the street.

On Queen, the principal residential street, single light standards will be installed as shown in the illustration. These will carry a 250-watt tungsten, each enclosed in a 16-in. Alba globe, be 84 feet apart, on both sides of the street and opposite as before, and will be fed through underground conduit.

Between Berlin and Waterloo, a distance of approximately one mile, ornamental trolley poles, placed on both sides of the street and spaced 100 feet apart, will carry four lamps each. This will join with the Waterloo Jandus system, described in the April number of the Electrical News.

It is understood that Galt will install a system of ornamental illumination in the near future. It is evident that the influence of proper illumination is something more than a creation of enthusiastic salesmen's imagination, and that it means more business and better business and more than all by its subtle influence tends to regulate the evils so prone to seek the dark corners of modern un-civilization.

The Berlin system has been planned under the direct eye of Mr. E. J. Philip, Electrical Superintendent, who will also have charge of the installation.

Motor-Generators for P. F. Correction

An interesting application of a synchronous motor-generator for power-factor correction is that of a 1,000 kv.a. set at the power house of the Spang Chalfont Company at Etna, Pennsylvania. There are two mills, the upper one being located near the power house, while the lower mill is about 4,500 feet distant. Under the conditions that obtained in the plant prior to the installation of the synchronous motor set, the upper mill was operating at a power-factor of about 48 per cent. Another synchronous set previously installed takes care of the lower mill, originally at about as bad a power-factor so that before the present set was installed, the generators at the power house operating at a power factor of about 75 per cent. To carry the load at this low power-factor it was necessary to operate four generating units in the power house, leaving no spare capacity.

The inherently low power-factor conditions were due to the presence of a large number of induction motors which are underloaded for a considerable portion of the time. It was necessary to install motors of sufficiently high kv.a. ratings to insure the torques demanded for handling the peak loads, and as the duty is intermittent the motors run on partial loads for relatively long periods.

The synchronous motor-generator set was temporarily installed in its present location in the power house so as to raise the power-factor sufficiently to allow of always shutting down one or two of the four generating units. This renders available one or two spare units against contingencies. Moreover, the d.c. generator of the synchronous motor set now carries the load of a former d.c. engine type generator, which still further introduces economy into the plant operation. Ultimately the set will be installed in a central location in one of the mills at the delivering end of a set of feeders so as to provide maximum power factor correction to transmission line and to generating equipment.

In operation, the synchronous motor of the set is over excited and thereby the power-factor on the generators has been increased to from 97 to 100 per cent. Under existing conditions, the motor is usually operated at twenty per cent. power factor leading. At present the actual kilowatt load on the generator of the set is small, which, with full kv.a. in-put to the motor, accounts for the low leading power-factor. The set in its present location is on the bus-bars and therefore relieves the generators only. When the set is moved to its ultimate location out in the upper mill it will be possible to utilize it still more advantageously, as a large amount of cable now required in the transmission of the extra current due to poor power-factor in the mill will be available for carrying other useful load.

The set is driven by a synchronous motor rated at 1,000 kv.a., 220 volts, three-phase, 30 cycles, 600 r.p.m. It is of the three-bearing design and has, for the synchronous motor, a direct-connected exciter, overhung on the shaft, beyond the generator outboard bearing. The generator is a direct-current 400 kw., 220 volt, compound wound machine.

Disastrous Fire in Sarnia

The recent disastrous fire on the property of the Sarnia Gas and Electric Light Company destroyed all the electric light plant and contents, with the exception of the boilers and some new electrical apparatus from the General Electric Company of Sweden, which was on the boiler room floor and was only damaged by water. The cause of fire has



The Destruction of Sarnia's Power Plant

never been settled and is supposed to be from spontaneous combustion. The fire destroyed two Wheelock engines, three a.c. generators, three d.c. generators, three exciter sets, two complete switchboards, two fifty-light c.c. transformers, tools, etc., and on the building the loss was \$4,000, nearly all covered by insurance. The company supply the street railway company with power and immediately got the loan of a 300 kw. generator and direct-connected engine (high

speed) from the Detroit United Railway Company and had the street railway running two weeks after the fire.

It happened that the company had a turbo-generator at Goldie & McCulloch Company's at Galt, nearly ready for testing at the time of the fire and had them work night and day and hired a special train of three cars to carry all the apparatus from Galt to Sarnia and had apparatus on the ground before the insurance adjusters were through making their valuations. It is expected that lights will be on again by August 23rd.

The company intend to build an absolutely fireproof power house on the same site and have placed orders with the Goldie & McCulloch Company for a 200 h.p. high speed direct-connected engine to be connected with an a.c. generator; with the Canadian Westinghouse Company for a 50 kw. capacity exciter set, and with the Canadian General Electric Company for a 100-light c.c. transformer and for a complete new switchboard. The accompanying photo illustrates the scene at the time of the destruction of the plant.

The work of construction and installation of the above will be in charge of Mr. W. Williams, manager and superintendent of the company.

Internal Indirect Illumination

By Mr. T. Leslie DeCew

The layman, in considering the illumination of an interior by artificial light, has in the past seen little more in the problem than hanging a sufficiently powerful light in the centre of the room and possibly supplementing this by a number of side lights. His idea usually is that if a sufficiently large flux of light is provided, all that remains to be done is to select lighting units that will suit his taste, and it is not at all uncommon to find that the owner of a building has made his selection without the slightest regard for efficiency, direction of the light, or suitable diffusion.

While all of these three features are of importance, possibly the one with which we should concern ourselves most is that of proper diffusion, not alone to avoid striking contrasts in different portions of an interior, but as well to

We have reached an age when competition is keener than ever before. In consequence our tension is greater, and we apply ourselves more diligently. Artificial illumination is readily available, and used so much more than in past years, that it is imperative we should take some action to protect ourselves from the abuse of what ought to be one of the greatest boons to the human race. Compare the number of school children wearing glasses to-day with those who wore them in your school days. If the cause for this does not lie in the idiotic application of artificial illuminants, then where?

Too much light is quite as bad as too little, and while it is tiring to work in a dim light it is equally tiring to work in a too bright light; but there is the happy medium which is neither too bright nor too dim for the work we are doing. The advent of the tungsten lamp marked an important epoch in the history of illumination, and was expected to do much toward dissipating the evils of artificial lighting. Continued use, however, proved that exposed light rays of such intensity were extremely irritating to the optic nerves,



Fig. 2—Indirect Illumination in the Home

causing violent headaches and severe tax on the nervous energy, and this prevailing condition was the cause of that great movement "The Conservation of Vision," which is now occupying the attention of laymen as well as architects and engineers throughout the civilized world.

Lighting by indirect methods appeals as a most rational solution, involving certain fixed engineering principles, and, when properly applied, producing most gratifying results. By this method no direct rays of light are in the field of vision, tungsten lamps are employed and back of each lamp is placed a powerful silver-plated glass reflector, the highest reflecting surface known to science. Great care has been exercised in the production of these reflectors to reduce loss of efficiency. They are constructed of one piece of glass corrugated both spirally and vertically which entirely eliminates dark lines on the ceiling toward which all of the light is directed. Rooms of different shape, size, or ceiling height may require different types of reflector to produce best results. This requirement has been anticipated by the manufacturers who are proceeding along strictly scientific lines.

The fixture itself is merely a covering for this interior equipment as described. It may be of any shape or design to conform best with the surroundings and, if constructed of the new composition which is gaining such favor the past few years, is quite as susceptible to wood finishes as to metal. Its important advantages, however, lie in the per-



Fig. 1—Excellent Distribution for Office Work

eliminate eye strain and undue tax on our nervous energy. In office lighting we should again consider rental costs. The rents in our modern skyscrapers are figured at so much per square foot floor-space, yet with the average lighting conditions we find that only a comparatively few feet of working space can be used owing to improper diffusion.

fect diffusion of light and elimination of shadows, so that, as the lamps are entirely hidden from view, the iris of the eye is permitted to dilate naturally, affording a restful vision free from eye-strain.

Reverting to a statement in the early part of this article which refers to the economy of office space, the indirect fixture is again ideal. The light is brought to the working plane by only one reflection and high efficiency is maintained, while the light is evenly distributed through the office rendering every portion equally desirable for desk use. The accompanying cut, Fig. 1, shows better than any written description, the excellent distribution of light from indirect lighting fixtures. This room is 32 feet by 93 feet, giving a surface to be illuminated of 2,980 square feet; the ceiling is 13 feet high. There are 14 fixtures of 300 watts capacity each, and these are suspended 43 inches from the ceiling. There is thus a total of 4,200 watts, or 1.41 watts per square foot and an average intensity of 3.7 foot-candles throughout the room. The great uniformity of light and the absence of deep shadows will be readily noted from the illustration.

The same reasoning applies for home use. In the living room it is no longer necessary, if inverted lighting is used, for the occupants to cluster beneath the light source. This is clearly shown in Fig. 2, which illustrates indirect lighting as applied to the home. It will be noted that every detail is brought out clearly, and that nearly all parts of the room have the same amount of illumination. Fixtures may readily be selected to harmonize with any scheme of room decoration without becoming prominent or glaring features of the arrangement. This type of fixture lends itself particularly well to the simple dignified treatment of rooms which is in best taste in correctly appointed homes of to-day.

There is much that might be said further on the subject of artificial lighting. It is one of vital importance, but strangely enough has been much neglected. In home building the owner and architect scheme to place their windows to obtain the most effective day light, but it is only recently that artificial lighting has been given a prominent place in the home requirements.

The Value of the Mercury Arc Rectifier

By Mr. A. E. Wilkes

There has existed for some time a demand for a compact, efficient and low-cost device for rectifying a.c. current for various purposes, particularly for charging storage batteries. Many more or less satisfactory auxiliary appliances for use with storage batteries have been developed from time to time, and a number of devices for charging batteries have been placed on the market. The best known devices for this purpose are the motor-generator set, the single-phase rotary converter, the synchronous or mechanically-driven rectifier and the chemical rectifier.

Without describing any of the above devices in detail, it may be of interest to mention some of the disadvantages that may be found in their use, which disadvantages in a measure have retarded the more general use of vehicles propelled by electricity, which have distinct advantages over vehicles driven by other motive power. With some suitable provision made for battery charging, that is simple, cheap and operative by unskilled help, the use of the electric vehicle will be greatly popularized and become the source of increased revenue to the central station.

The Motor-Generator Set.—This is high in first cost, and requires large floor space for installation. The efficiency at full load of sets of proper size for charging vehicle batteries has been comparatively low and at light loads, very low.

Single-Phase Rotary Converter.—This is not so flexible

as the motor-generator set, particularly as regards voltage, and it requires a higher grade of intelligence to insure satisfactory operation.

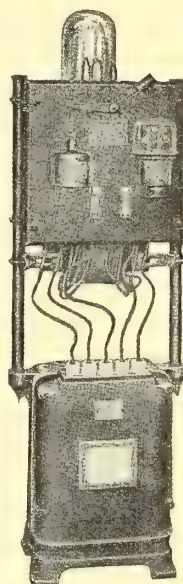
The Synchronous Rectifier.—The synchronous or mechanically-driven rectifier is small but requires considerable attention, as the d.c. brushes are apt to spark badly and require constant renewals, attention and adjustment.

The Chemical Rectifier.—The action of the chemical rectifier has not in the past been found uniform or reliable, and its efficiency has been low under all conditions.

The Mercury Arc Rectifier

The mercury arc rectifier is the latest and best device that has been produced for the rectification of alternating current and is free from any of the objections referred to in the previous paragraphs. It has a low first cost, requires a floor space of something like 20 in. by 16 in., has remarkably high efficiency, and is very simple to operate. The writer remembers seeing an extract from a letter which said "The rectifier has been operated by me or by the coachman, an intelligent Irishman with no experience in electrical appliances, and at no time has the rectifier given us any trouble."

The only part of a rectifier set that can require main-



Moving Picture Rectifier



Battery Charging Rectifier

tenance is the tube. The life of the tube under normal conditions is at least 600 hours. Just as it has been a matter of extreme difficulty to ascertain the average life of incandescent lamps, so it will be appreciated, the same difficulties are met in regard to arriving at an average life of m.a.r. tubes. As the cost of renewals is merely nominal and the other advantages of the rectifier so numerous, the question of life is not one of paramount importance, but in any case, the saving in cost of energy due to the higher efficiency of the rectifier set over the motor generator set is sufficient to pay for a new tube in approximately 200 hours, even in the case of where a moderately low voltage battery is in use.

Below is a single example of the saving in cost of operation of the mercury arc rectifier set over a motor-generator set, when charging a 44-cell battery, the battery being charged in accordance with time and current recommended by the manufacturer.

Motor-Generator Set.—

First part of charge is at 28 amperes and 106 volts (average) for five hours.

Efficiency of set at this load is 62 per cent.

Second part of charge is at 12 amperes and 108 volts (average) for two hours.

Efficiency of set at this load is 36 per cent.

$$28 \times 106 \times 5$$

First part of charge = $\frac{28 \times 106 \times 5}{62 \text{ per cent.}}$ = 23.93 kw.h. from

service mains.

$$12 \times 108 \times 2$$

Second part of charge = $\frac{12 \times 108 \times 2}{36 \text{ per cent.}}$ = 7.20 kw.h. from

service mains.

Total, 31.13 kw.h. from service mains.

When figured at 6 cents per kw.h. cost is $31.13 \times .06$ or \$1.867 per charge.

Mercury Arc Rectifier,—

$$28 \times 106 \times 5$$

First part of charge = $\frac{28 \times 106 \times 5}{80 \text{ per cent.}}$ = 18.5 kw.h. from

service mains.

$$12 \times 108 \times 2$$

Second part of charge = $\frac{12 \times 108 \times 2}{81 \text{ per cent.}}$ = 3.2 kw.h. from

service mains.

Total, 21.7 kw.h. from service mains.

When figured at 6 cents per kw.h. cost is $21.7 \times .06$ or \$1.302 per charge.

Cost per charge motor-generator set \$1.867

Cost per charge mercury arc rectifier 1.302

Saving per charge \$0.565

Assuming the minimum life figure of 600 hours, seven hours per charge equals 86 charges during life of tube. Total saving during life of tube = $\$0.565 \times 57 = \48.59 . In this particular example at 6 cents a kilowatt hour, the saving is sufficient to pay for a new tube in about 186 hours.

In conclusion, it seems that if the central station will take up the rectifier for such purposes as above and push its use, a considerable increase in load will unquestionably result, in addition to the load factor being greatly improved. The above remarks have had reference only to the uses of the rectifier on vehicle batteries, but it can be used for launches, central station telephones, moving picture machines, photographers' arc lamps, X-ray machines, and a variety of other purposes.

Condensers for Metal Filament Lamps—Their Use Advocated for Voltage Reduction on Lighting Circuits

In using metal filament lamps on high-volt circuits consumers are faced with the impossibility of obtaining low candle-power lamps for this voltage, and furthermore, all high-volt filament lamps are more costly, less efficient, and more fragile than lower volt lamps. In addition, a low-voltage lamp continues to give its full candle-power for a considerably longer time than a high-voltage lamp, due to the fact that blackening does not take place to the same extent.

To obtain the above advantages it has been the practice to install auto-transformers on alternating current circuits to lower the pressure to 55 or 28 volts. This entails considerable first cost for installing transformers and new lamps, besides additional running costs due to the "no load" losses in the transformer. These losses occur during the whole time the transformer is switched on, and even if they are as low as 8 watts will consume about 70 units per annum. The losses can, of course, be reduced by switching off the transformer during the day, but this throws away one of the greatest advantages of electric light, viz., its availability at all times. The installation of a trans-

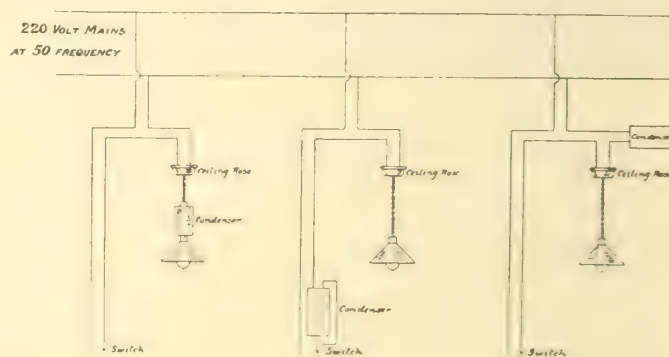
former also necessitates additional and more expensive wiring where electric heaters, cookers, fans, etc., are required.

By the use of condensers in place of transformers such "no load" losses are entirely obviated; the light is immediately available, there is the full voltage at any point for heating, etc., and lamps of any voltage, however small, can be installed. It is claimed they do not deteriorate in use. They have no moving parts, and cannot get out of order. Of all advantages perhaps the most important are the absence of any loss in the condenser and the prevention of the well-known rush of current when switching on a metal filament lamp. Owing to the low resistance of the cold filament, the initial current is sometimes ten times as much as the normal current of the lamps. Any one with experience of metal filament lamps is aware that they never break when lighted but nearly always fail at the moment of switching on. These failures are evidently due to the initial heavy rush of current, which is entirely prevented by the condenser, for where a condenser is employed the normal current can in no circumstances be exceeded by more than about 10 per cent.

Another distinct and important advantage is the action of the condenser in limiting the current than can be taken from the circuit. This prevents any danger through "short-circuiting" or fusing of flexibles, lamp-holders, wall plugs, etc., an effect of particular interest in connection with the employment of reading lamps, candle lamps, trailing flexibles, or movable lamps.

In order to use a low-voltage lamp on a high-voltage alternate-current circuit, a condenser of suitable capacity is connected in series with the lamp. This acts as a resistance in absorbing the excess voltage; but, whereas a resistance consumes power, the condenser absorbs voltage without appreciable loss. There are two methods of apply-

PARALLEL SYSTEM.



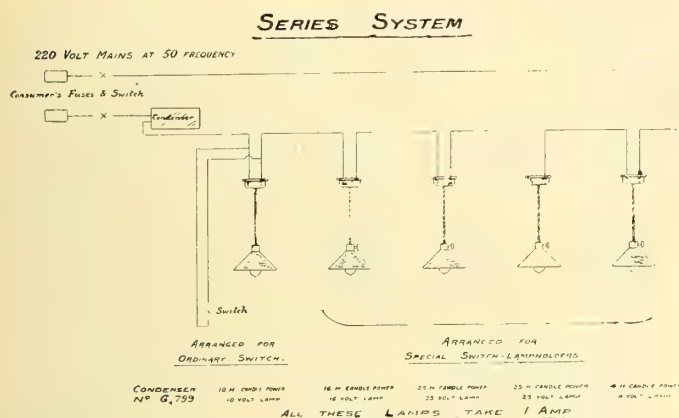
ing the condensers. The first is the Parallel System, in which all the circuits are in parallel, and in which each circuit consists of a lamp and a condenser in series; the other method may be termed the Series System, where a number of lamps of low voltage are connected in series with each other and a condenser, the individual lamps being controlled by short-circuiting switches. These systems are briefly described below.

Parallel System

The Parallel System is easily applied to houses already wired, and can be adopted for any number of single lamps or groups of lamps as may be convenient; lamps not arranged for control by a condenser would be left to run at their original voltage. The flexibility of the system is such that it can be applied to those points where the greatest saving can be effected, that is to say, where low candle-power lamps are sufficient, without interference with those points where high candle-power lamps suitable for the full

pressure of supply, are necessary. For instance, a 10 watt lamp gives quite sufficient light for small entrance halls, bathrooms and bedrooms, etc., and the extension of electric lighting to these places has been restricted for want of a convenient method of employing on ordinary supply voltages a strong, cheap, and efficient low candle-power lamp.

The Parallel System can be installed with a minimum disturbance of the wiring. The condenser may be fixed under the floor, above the ceiling rose or on the wall near the switch. In the small sizes a cylindrical type is made provided with an adaptor and a lamp-holder, which permits the insertion of a condenser between any lamp and its



original holder. Generally, it may be stated that the saving effected during the life of the first lamp exceeds the cost of the condenser.

Series System

In the Series System all the lamps are connected in series with each other and with the condenser, and connected in circuit across the mains. Switches are fixed in parallel with the lamps, so that when a switch is closed the corresponding lamp is short circuited. Provided that the sum of the voltages of the lamps in use at the same time does not exceed 40 per cent. of the supply voltage, it can be shown that each lamp practically gets its correct current however many lamps are switched on.

In order to obtain full advantage of the protection which the condenser affords to the wiring, it is advisable to place the condenser as close as possible to the supply company's fuses. This system is particularly suitable for application to new installations and extensions to old installations, or to special cases, such as a number of lamps on a single fitting. It will generally be found that the cost of the condenser is not much more than the saving effected in the first cost, due to the use of low-voltage lamps.

Certain points must be remembered when arranging the installation for the Series System. All lamps employed in any one series circuit, as well as the condenser, must be rated for the same current. The sum of the voltages of all the lamps which may be alight at the same time, must not be greater than 40 per cent. of the supply voltage; but in most cases all lamps are not in use at one time, therefore the total voltage of all the lamps in series may, as a rule, amount to 60 per cent. of the supply voltage. The lamps in series may be of any candle-power, the higher candle-powers being obtained by using higher-voltage lamps, care being taken to keep the same rated current. When lamps sufficient to use up 40 per cent. of the supply voltage are alight, each lamp will give its correct candle-power, and however many are switched off those remaining alight will not be appreciably affected; this is the case although only one 10 candle-power lamp is left burning. On the other hand, if more than the maximum lights likely to be

employed at any one time are in use, there will be only a slight reduction in candle-power all round, and even if all are alight at one time the only effect is to still further reduce the candle-power.

These condensers are being now placed on the market by the British Insulated and Helsby Cables, Ltd. Figures submitted for an electric lighting system in an average 6-roomed house show a saving, considering cost of lamps, current consumed and renewals, of approximately \$8.00 the first year and \$11.00 per year afterwards.

In this connection an interesting paper was recently read by Mr. A. W. Ashton before the Institution of Electrical Engineers in which he describes certain developments which have recently taken place in connection with the running of low-voltage metal filament lamps in series with condensers on alternating circuits. An account is given of an important improvement in the process of manufacturing paraffin-paper condensers, which has made the condenser much more suitable for use on ordinary lighting circuits. A method of running a variable number of lamps in series with a single condenser is described, and the "current limiting" property of the condenser in preventing "overshoot" when switching on metal filament lamps and in cheapening the wiring of small houses are dealt with. The effect on the power-factor of public supply systems caused by the extensive use of condensers is also considered.

Resuscitation from Electric Shock — Latest Approved Methods of Restoring Persons Subjected to Electric Shock

A set of rules for resuscitation from electric shock, recommended by the Commission on Resuscitation from Electric Shock, representing the American Medical Association, the National Electric Light Association, and the American Institute of Electrical Engineers, has just been issued by the National Electric Light Association. As it is all-important that electrical operators should be thoroughly conversant with the best means of rendering instant aid to one subjected to electric shock we print the rules in full as follows:—

"An accidental electric shock usually does not kill at once, but may only stun the victim and for a while stop his breathing. The shock is not likely to be immediately fatal, because:

(a) The conductors may make only a brief and imperfect contact with the body.

(b) The skin, unless it is wet, offers high resistance to the current.

Hope of restoring the victim lies in prompt and continued use of artificial respiration. The reasons for this statement are:

(a) The body continuously depends on an exchange of air, as shown by the fact that we must breathe in and out about fifteen times a minute.

(b) If the body is not thus repeatedly supplied with air, suffocation occurs.

(c) Persons whose breathing has been stopped by electric shock have been restored, in some instances, after artificial respiration has been continued for an hour or more.

The Schafer, or "prone pressure" method of artificial respiration, slightly modified, is illustrated and described in the following resuscitation rules. The advantages of this method are:

(a) Easy performance; little muscular exertion is required.

(b) Larger ventilation of the lungs than by the supine method.

(c) Simplicity; the operator makes no complex motions and readily learns the method on first trial.

(d) No trouble from the tongue falling back into the air passage.

(e) No risk of injury to liver or ribs if the method is executed with proper care.

Aid can be rendered best by one who has studied the rules and has learned them by practice on a volunteer subject.

Instructions for Resuscitation—Follow the Instructions Even if the Victim Appears Dead

I.—Break the Circuit Immediately—With a single quick motion separate the victim from the live conductor. In so doing avoid receiving a shock yourself. Many have, by their carelessness, received injury in trying to discon-

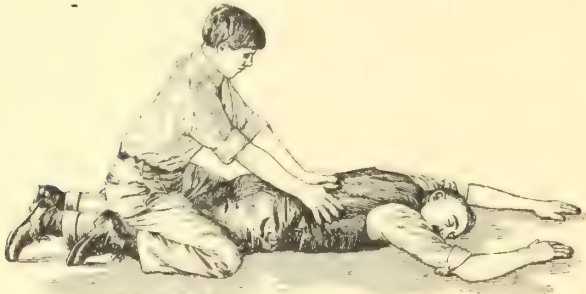


Fig. 1

nect victims of shock from live conductors. Observe the following precautions,—

(a) Use a dry coat, a dry rope, a dry stick or board, or any other dry non-conductor to move either the victim or the wire, so as to break the electrical contact. Beware of using metal or any moist material. The victim's loose clothing, if dry, may be used to pull him away; do not touch the soles or heels of his shoes while he remains in contact—the nails are dangerous.

(b) If the body must be touched by your hands, be sure to cover them with rubber gloves, mackintosh, rubber sheeting or dry cloth; or stand on a dry board or on some other dry insulating surface. If possible, use only one hand.

(c) If the victim is conducting the current to ground, and is convulsively clutching the live conductor, it may be easier to shut off the current by lifting him than by leaving him on the ground and trying to break his grasp.

(d) Open the nearest switch, if that is the quickest way to break the circuit.

(e) If necessary to cut a live wire, use an axe or a hatchet with a dry wooden handle, or properly insulated pliers.

II.—Send for the Nearest Doctor—This should be done without a moment's delay, as soon as the accident occurs, and while the victim is being removed from the conductor.

III.—Attend Instantly to Victim's Breathing,—

(1) As soon as the victim is clear of the live conductor, quickly feel with your finger in his mouth and throat and remove any foreign body (tobacco, false teeth, etc.) Then begin artificial respiration at once. Do not stop to loosen the patient's clothing; every moment of delay is serious.

(2) Lay the subject on his belly, with arms extended as straight forward as possible, and with face to one side, so that the nose and mouth are free for breathing (see Figure 1). Let an assistant draw forward the subject's tongue. If possible, avoid so laying the subject that any burned places are pressed upon. Do not permit bystanders to crowd about and shut off fresh air.

(3) Kneel straddling the subject's thighs and facing his head; rest the palms of your hands on the loins (on the muscles of the small of the back), with thumbs nearly touching each other, and with fingers spread over the lowest ribs (see Figure 1).

(4) With arms held straight, swing forward slowly so that the weight of your body is gradually brought to bear upon the subject (see Figure 2). This operation, which should take from two to three seconds, must not be violent—internal organs may be injured. The lower part of the chest and also the abdomen are thus compressed, and air is forced out of the lungs. Now immediately swing backward so as to remove the pressure, but leave your hands in place, thus returning to the position shown in Figure 1. Through their elasticity, the chest walls spring out and the lungs are thus supplied with fresh air.

(5) After two seconds swing forward again. Thus repeat deliberately twelve to fifteen times a minute the double movement of compression and release—a complete respiration in four or five seconds. If a watch or a clock is not visible, follow the natural rate of your own deep breathing—swinging forward with each expiration, and backward with each inspiration. While this is being done an assistant should loosen any tight clothing about the subject's neck, chest, or waist.

(6) Continue artificial respiration (if necessary, at least an hour), without interruption, until natural breathing is restored, or until a physician arrives. Even after natural breathing begins, carefully watch that it continues. If it stops, start artificial respiration again. During the period of operation, keep the subject warm by applying a proper



Fig. 2

covering and by laying beside his body bottles or rubber bags filled with warm water. The attention to keeping the subject warm should be given by an assistant or assistants.

(7) Do not give any liquids whatever by mouth until the subject is fully conscious.

First Care of Burns

When natural respiration has been restored, burns, if serious, should be attended to until a doctor comes.

A raw or blistered surface should be protected from the air. If clothing sticks, do not peel it off—cut around it. The adherent cloth, or a dressing of cotton or other soft material applied to the burned surface, should be saturated with picric acid (0.5 per cent.). If this is not at hand, use a solution of baking soda (one teaspoonful to a pint of water), or the wound may be coated with a paste of flour and water. Or it may be protected with a heavy oil, such as machine oil, transformer oil, vaseline, linseed, carron or olive oil. Cover the dressing with cotton, gauze, lint, clean waste, clean handkerchiefs, or other soft cloth, held lightly in place by a bandage.

The same coverings should be lightly bandaged over a dry, charred burn, but without wetting the burned region or applying oil to it.

Do not open blisters.



A section of delegates at the recent Canadian Electrical Association Convention, Ottawa

P. W. Sothman & Company

Following the recent report that Mr. P. W. Sothman had resigned his position as chief engineer of the Hydro-electric Power Commission of Ontario, comes the later announcement that an engineering firm has been formed under the name of P. W. Sothman & Company, with offices in the Kent Building, Toronto, Ont. Beginning August 1st the services of this firm will be available in the capacity of consulting, constructing, and operating engineers and specialists in hydro-electric development, high tension power transmission and other work connected with the generation and distribution of electrical energy. Along with Mr. Sothman in the firm are associated the names of Mr. J. A. Brundige and Mr. F. P. Mansbendel. Of Mr. Sothman it is unnecessary to speak in detail, as his work is known the world over, from his connection with the Ontario Commission, and the construction of their high tension line and distribution system. Both Mr. Brundige and Mr. Mansbendel follow Mr. Sothman from the Hydro-electric Commission, where they have gained valuable experience during the past years. Mr. Brundige is a graduate of the University of Illinois in mechanical and electrical engineering. He was for six years with the Ontario Power Company in the engineering department. For the last three years he has been with the Ontario Commission, where he has been connected with the designing and testing work of the transmission line, and later has had charge of the operating department in connection with the various sub-stations. Two years ago Mr. Brundige was one of the engineers sent by the government to Europe in search of information, where he

gained first-hand experience in the inspection and testing of insulators and other apparatus.

Mr. Mansbendel is a graduate of the Polytechnical Institute of Winthur, Switzerland. He was for four years with the Allgemeine Elektrizitäts Gesellschaft as head of the designing and development department. He was with the Westinghouse and certain steel concerns in Pittsburgh for three years and for a time was chief designer of the National Electric Signal Company, working with Professor Fessenden. For the last four years, he has been with the Hydro-electric Commission of Ontario, and has had charge of much of the insulator testing and the development of the telephone system. During construction, he was chief inspector of the electrical equipment and paid a visit to Europe in connection with insulator work. Latterly he has been specially detailed on testing and development work for the Commission.

Decision Favors Ontario Government

The Privy Council has just handed down a decision in the matter of the rentals payable by the power companies operating at Niagara Falls, Ont., for the Queen Victoria Park maintenance. The companies have all along maintained that the amount of power generated and sold from day to day was the proper basis of computation, but the Ontario Government interpreted the agreement to require payment according to the peak load, the correctness of which interpretation is now confirmed by the Privy Council. The arrears of payments to the Park Commission will amount to something over \$100,000.

Montreal and Eastern Canada

Indirect Lighting by Arc Lamps

At the second meeting of the members of the Montreal Electrical Society, Mr. Justus Eck, M.A., M.I.E.E., president of the Canadian Union Electric Company, Limited, read a paper on "Indirect Lighting by Arc Lamps." After pointing out that indirect lighting was recognized to be the best form of lighting, Mr. Eck argued that arc lamps for indirect lighting are the most profitable from the contractors' point of view and the most economical and most satisfactory from the users' point of view. Taking up the question from the contractors' view point, it was said that when indirect arc lamps are installed, the initial capital outlay is usually less than in the case of an installation of incandescent lamps and the cost of labor is also less, thus securing to the contractor the advantage of a definite profit on goods and no risk of filament breakage, to say nothing of the possibility of securing orders for carbons or a contract for the trimming and maintenance of the lamps.

Mr. Eck referred to the users' point of view and gave figures of certain tests made in England, which he said showed that by indirect lighting one could do the same work under more comfortable and health-preserving conditions with a total illumination of approximately 80 per cent. less than is required by direct lighting. The tests in question were very exacting ones but a reduction in the actual illumination required, of from 30 to 50 per cent., is frequently obtained in practice under ordinary working conditions. Moreover, the efficiency of arc lamps—the candle power developed per watt of energy consumed—is so much greater than that of incandescent lamps that the illumination necessary can be obtained at a much less annual running cost even after allowing liberally for carbons, trimming and renewals to glassware, where such is used, than that at which equivalent illumination can be obtained by the employment of the most efficient filament lamps. A certain well-known testing authority of the highest standing in the electrical world recently carried out a very complete series of independent tests upon a large number of direct current metal lamps, obtained, with their knowledge, from almost all the leading makers. An examination of these tests shows conclusively that the average consumption of all the lamps tested taken over a period of 1,000 hours was 158 watts per hour horizontal candle power, and that the average economical life of the lamps—that is to say, the period during which the watts per horizontal candle power did not exceed 1.5, which is considered the limit to which any metallic filament incandescent lamp can reasonably be used—was not more than 463 hours. The figures given out by many individual lamps are very much less satisfactory than those quoted, and as the same has never been disputed by the lamp makers, none of whom have apparently been able to produce more satisfactory average results in practice, they may without hesitation be accepted as correct.

Mr. Eck gave certain figures to prove his contention that notwithstanding the losses due to absorption by reflecting surfaces, a given illumination, plus all the advantages of indirect lighting, can be produced as economically, and in certain cases more economically, by arc lamps arranged for inverted or indirect lighting than by incandescent lamps, plus reflecting shades arranged for direct lighting. In one case recently worked out, the percentage in favor of the arc lamps, taking renewals of incandescent lamps in one case and cost of carbons and labor in trimming in the other, was 25 per cent.

Mr. Eck has returned to England after a two-months' visit in Canada. He went as far west as Winnipeg, investi-

gating conditions and the outlook for business which he reported to be very good. He hopes to return to Canada in a short time.

Many Admitted to Order

The order of the Rejuvenated Sons of Jove recently held a rejuvenation at the Windsor Hotel, Montreal, at which 26 new members were admitted to the order. Mr. W. J. Doherty, Statesman of the Order for the Province of Quebec, presided. The following gentlemen were admitted:—Messrs. James Joseph Campbell, Manager, Kilmer, Pullen & Burnham, Limited, Montreal; Joseph David Lachapelle, Eastern representative of R. E. T. Pringle, Montreal; William Micou Turnley, district sales manager, the Northern Electric & Manufacturing Company, Limited, Montreal; Carr Lane Glasgow, district manager, Allis-Chalmers-Bullock, Limited, Montreal; James Archibald Hall, salesman, Duncan Electric Company, Limited, Montreal; Phillip Sylvanus Ferguson, treasurer, the McDonald & Willson Company, Limited, Montreal; Hugh Crumay Spryer, sales department, the Northern Electric & Manufacturing Company, Limited, Montreal; Joseph Ambrose Dawson, president, Dawson & Company, Limited, Montreal; Ernest Walter Sayer, general manager, Sayer Electric Company, Montreal; James McCallum Robertson, president, J. M. Robertson, Limited, Montreal; Thomas Reid, sales manager, Walpole Rubber Company, Limited, Montreal; A. Dwight Smith, sales department, Northern Electric & Manufacturing Company, Limited, Montreal; Frederick John Parsons, managing director, the McDonald & Willson Company, Limited, Montreal; Charles Duncan, Duncan Electrical Company, Limited, Montreal; James Bennett, Chief Electrical Inspector, Canadian Fire Underwriters' Assn., Montreal; George Marshall Wight, Managing Director and Treasurer, Monarch Electric Company, Limited, St. Lambert, Que.; Andrew Jackson Carroll, Salesman, the Eugene F. Phillips Electric Works, Limited, Montreal; Harry Duckworth Bayne, Special Agent, Canadian General Electric Company, Toronto; Geo. L. Hathaway, salesman, Pass & Seymour, Inc., New York; Lee August Johnson, Chief Storekeeper, Northern Electric & Manufacturing Company, Limited, Montreal; Alex. Friedman, Canadian Representative, Fco. Glanzmann, of Trieste, Austria, Montreal; James Mather Goodwin, Sales Department, Northern Electric & Manufacturing Company, Limited, Montreal; Harry Dalzell Browne, General Purchasing Agent, Northern Electric & Manufacturing Company, Limited, Montreal; Bradley Thomas MacCormick, Allis-Chalmers-Bullock Company, Limited, Montreal; Dew Granville Smith, president, Smith Hardware Company, Montreal; W. J. Wall, Manufacturers' Agent, W. J. Wall, Montreal.

The officers of the rejuvenation are as follows:—Jupiter, W. J. Doherty; Neptune, C. R. Hammond; Pluto, F. W. King; Vulcan, R. J. Hillier; Avenim, W. A. Baker; Hercules, E. B. Pike; Mars, M. P. Ellis; Apollo, J. F. Ward; Mercury, G. C. Knott.

It is the intention to hold another rejuvenation about October 1st, at which time it is expected to increase the membership in Montreal by nearly 100. Mr. Doherty's address is 814 Notre Dame street west, Montreal.

De Gaspe Beaubien Member of Conduits Commission

Mr. De Gaspe Beaubien has been appointed by the city of Montreal a member of the Conduits Commission, replacing Mr. Beaudry Leman, resigned. There were several applications for the position. Mr. Beaubien is a native of Montreal and received his professional training as an elec-

trical engineer at McGill University. After graduating, he was appointed demonstrator for third and fourth year students at the University. Mr. Beaubien then went with the Westinghouse Company at Pittsburgh, and later has practised in Montreal as consulting engineer. He has been connected with installations for the city of Winnipeg, St. Jerome, and Drummondville; he has also carried out work for the Ontario Pipe Line Company, of Hamilton, and the Acadia Coal Company.

Halifax Electric Tramway

The Halifax Electric Tramway Company controls the street railway system, all the electric lighting and power, and the gas supply in the city of Halifax, N.S. The steady rise in the price of its securities on the Montreal market during the last few years is evidence of the efficient management of the company. The power house is situated on the waterfront in the south end of the city. Coal is brought from Sydney in barges and is transferred from them directly to the storage bins and the floor of the boiler room. It is then shovelled into the hoppers of the underfeed stokers. As only one man is required to look after the boilers and do all the shovelling it would not pay to take the coal from bins to the fires mechanically.

There are seven 300 h.p. Babcock & Wilcox boilers giving steam at 150 lbs. pressure with 100 deg. superheat. The supply is controlled by the draught. As soon as the pressure drops below 150 lbs. the blower engine starts up and the stokers accelerate until 150 lbs. is reached again. There being an inexhaustible supply of salt water always at hand, jet condensers of the vertical, twin type are used, joined three in multiple.

There are at present three generating units, each consisting of a 900 h.p. horizontal, cross-compound, Corliss engine made by Rice & Sargent, direct connected to a revolving field G. E. generator rated at 600 kw., 2300 volt, 60 cycles. The power is transmitted all over the city at the generated voltage of 2300. The 500 volt d.c. required for the street railway is converted from the 2300 volt a.c. by motor generators. The oiling system in the plant is most ingenious and economical. The oil is forced through a filter to the bearings and back to the filter by the pressure of the city water supply. The only attention it needs is an application of the condenser vacuum once a day. One pound of oil is used for every 27,500 h.p. hours and one pound of waste every day.

The power is used chiefly for lighting and the street railway so the load is very variable. The lighting load is the most important. There are connected 400 street arcs of $7\frac{1}{2}$ amps. and 75 volts, 150 commercial arcs of $6\frac{1}{2}$ amps. and 75 volts, and incandescent lamps equivalent to 66,000-16 c.p. carbon lamps, giving a total of 4,000 kw. connected. The actual peak is 1400 kw. or 35 per cent. The maximum taken by the street railway is 600 kw. There are also connected small motors aggregating 1900 kw., taking a peak of only 220 kw. or less than 9 per cent. Thus the maximum peak carried by the station amounts to 2200 kw. when the generators are overloaded 22 per cent.

The street railway is going ahead at a fair rate. The six and one-half miles of main line and the five and one-half miles of loop are now double-tracked. About two miles more of single track will be laid this year. Eight new cars have been ordered from the N. S. Car Works and a brick car barn of sixteen cars capacity is being built.

To take care of the increasing load another machine is being installed. It is a 2,000 kw. horizontal G. E. turbo generator giving 2300 volts at 60 cycles. A turbo exciter set and complete switchboard are also being put in by the G. E. Company.

The present boiler installation is large enough to sup-

ply the enlarged plant, but a Worthington surface condenser has been ordered. The power house building will not have to be enlarged as the new machine only takes up a floor space of 19 ft. x 8 ft. It will be running by October ready for the yearly peak which comes in December.

Mr. P. A. Freeman is operating engineer and is also responsible for the new construction work.

Mr. McDonald Leaves Montreal Tramways

Mr. Duncan McDonald has resigned his position as general manager of the Montreal Tramways Company, and has been succeeded by Major J. E. Hutcheson, superintendent of the Ottawa Street Railway since its inception twenty-one years ago. The resignation of Mr. McDonald is due to other interests claiming his attention. Mr. McDonald was the inventor of the p.a.y.e. system of collecting street railway fares and is president of the American P-a-y-e Company, constructing all the pay-as-you-enter cars on this continent; he is a member of the International P-a-y-e Tramcar Company, with offices in England, in addition to being connected with several Montreal industrial concerns. Mr. McDonald is a member of the Civil Engineers of France, also a member of the Institute of Electrical Engineers of Great Britain. He has been with the Montreal Tramways Company since 1892, when the electric system was inaugurated. His office has been opened in the Transportation Building, Montreal, where Mr. McDonald will look after his various interests.

South Shore Power & Paper Company

At the beginning of this year the South Shore Power & Paper Company, Limited, was organized, with offices in Montreal, with the object of developing water power on the St. Francis River, P.Q. Several water rights within a radius of ten miles of Drummondville have been acquired, and the directors have under consideration a scheme for developing 10,000 horse-power. An agreement has been made to take over that town's electric light plant when this power is available. It has also been decided to build a large paper and pulp mill. Power is given in the charter to furnish electricity to many villages and towns within fifty miles of Drummondville. Certain Syracuse, N.Y., capitalists are interested, Mr. C. W. Tooke, of that city, being president. Mr. W. L. Haskell, of Montreal, is vice-president; Mr. W. I. Bishop, of Montreal, is a director, and Mr. L. C. Haskell, secretary-treasurer. The capital is two million dollars.

Progress on Granby Extensions

Engineers for the Montreal & Southern Counties Railway are now at work on the proposed extension to Granby from Richelieu to St. Cesaire, a distance of 15 miles. Everything is ready for the work of the roadbed, and from St. Lambert to the other side of the Richelieu, 14 miles, the overhead work is completed, while the relaying of rails and rebuilding the old Central Vermont is now in operation. The Canadian Westinghouse Company have received an additional order for electric apparatus in connection with the sub-station. Orders have also been given to the Northern Electric & Manufacturing Company for a switchboard, while other work will be done by the Ohio Brass Company, the Dominion Steel Corporation, the Steel Company of Canada, and the United States Steel Products Company.

Will Comply With Commission's Order

At a sitting of the Railway Commissioners held in the city of Quebec, an application from the Public Utilities Commission directing the C. P. R., the Great North Western Telegraph Company, the Quebec Railway, Light, Heat & Power Company, and the city of Quebec to comply with the order of the Commission, rectifying electrical conditions in

the city, was heard. The companies took exception to the jurisdiction of the Public Utilities Commission, but afterwards agreed to do the required work, and the application was therefore withdrawn. The commissioners, however, expressed doubt as to whether they had any jurisdiction in the matter.

Another Unit for Shawinigan Falls

The Canadian Westinghouse Company, Limited, have secured a contract from the Shawinigan Water & Power Company, Shawinigan Falls, Que., for one 15,000 kw. two-bearing water-wheel type, 60 cycle generator, which is the largest water-wheel generator to be installed in Canada to date. This will be the third unit which the Westinghouse Company will have furnished from their Hamilton shops for the new power house of the Shawinigan company, the other two units being of slightly smaller capacity, viz., 14,000 kw.

Deepening Beauharnois Canal

For several months the Canadian Light & Power Company have been engaged in deepening the old Beauharnois Canal from Valleyfield to St. Timothy in order to provide for an additional head of water at the power house. It is now officially announced that by the early fall the excavation will reach the required depth of twenty-two feet which will give the company the full flow required at the present stage of operations.

1,000 Members by January 1

The Montreal Electrical Society has decided on a plan of campaign with the object of securing 1,000 members by January 1, 1913. In addition to circularizing all the big electrical firms, a competition between two sides of the members—to be known as "Volts" and "Amperes"—is to be inaugurated. It is hoped in this way to stimulate enthusiasm among present members in securing the largest number of additions to the Society.

Inspecting Outlying Districts

Following the recent inquiry into the Montreal rates of the Bell Telephone Company, the members of the Railway Commission have made an inspection of the telephone limits. The Commissioners were accompanied by representatives of the city and the company. Various outlying points were visited, having in view the contention of the city council that rate discrimination prevails in certain districts.

Ottawa Electrical Installations

Marchand & Donnelly, electrical engineers and contractors, of Ottawa, Ont., have recently been awarded some large contracts there for electric installations, among them being the new hospital, Y. W. C. A. building, Masonic Temple, C. J. Booth building, Bank of Ottawa, Somerset St. Branch, as well as the large new hydro-electric plant at Castleman, the whole installations in the latter being done by this firm.

Miscellaneous

Messrs. Charles Brandeis and H. Dunlap Morrison have been appointed supervising designers and engineers for a new ten-storey office and light manufacturing building, known as the "Unity Building," now being erected at the corner of St. Alexander and Lagauchetiere streets, Montreal, for the Industrial Securities Corporation, Inc., at a cost of about \$250,000. The Bishop Construction Company, Limited, are the general contractors.

Notwithstanding the hot weather, the midday lunches, on Thursdays, of the Electrical Association of the Province of Quebec, Montreal, are well attended. Two of the mem-

bers are engaged in a contest as to which shall secure the greater attendance. At one of the recent lunches there was a talk on points not dealt with in the National Code, and many questions of a controversial character relating to the code were freely discussed.

The Court of Appeal, Montreal, has decided that the Street Railway Co. have no right to carry freight. The company were originally fined \$25 for the offence, and now argued that the city had no right of action because it had acquiesced in the illegal act of the company. It was established that the city had requested the company to carry 44,000 tons of stone.

Mr. R. A. Ross, of Montreal, is one of a commission of three which is preparing a report on the public utilities of Edmonton, including the street railway and the power and lighting plant. The latter is believed to be not up to modern requirements, and the probabilities are that it will have to be almost entirely replaced.

In conjunction with Lee, Higginson & Co., of Boston, the Royal Securities Corporation have purchased \$1,750,000 five per cent. bonds of the Bell Telephone Company of Canada. The money is required for extending the system.

First mortgage five per cent. bonds of the Dorchester, P. Q., Electric Company to the extent of \$250,000, have been offered on the London market. The price is 95 with a bonus of 25 per cent. common stock.

The Robb Engineering Company, Limited, Amherst, N.S., is being re-organized, and a new company formed to take over the existing concern. The outstanding liabilities amount to \$900,000.

The Montreal Light, Heat & Power Company have increased their dividend from 8 to 9 per cent., the quarterly distribution last announced being $2\frac{1}{4}$ per cent.

Territorial Light & Heat Limited has been incorporated with a capital of \$100,000. The head office of the company is in Vancouver.

Mr. Lawford Grant, manager the Canadian British Insulated Company, Limited, Montreal, has been on a visit to the West.

Recent Publications

The Bureau of Railway Economics, established by the railways of the United States for the scientific study of transportation problems, has just issued, from Washington, D.C., Bulletin No. 34, containing a comparative study of railway wages and the cost of living in the United States, the United Kingdom, and the principal countries of Continental Europe.

Steam Turbines—By H. Zoelly, Zurich, inventor of the Zoelly steam turbine, and general manager of the Escher Wyss & Company. This is a reprint of a paper read before the Institution of Mechanical Engineers, copies of which may be obtained from the head office in Montreal of the Escher-Wyss Company.

High-Pressure Water Power Works—By L. Zodel, Zurich, Chief of the Water Turbine Department of the Escher-Wyss Company. This is a reprint of a paper read before the Institution of Mechanical Engineers and deals with typical water-power developments carried out by this company. The booklet also contains the results of experiments with Francis turbines and tangential turbines recently carried out by Prof. Prazil, of Zurich, Switzerland.

Canada's Prairie Provinces

Emergency Telephone Work in Regina

The recent cyclone disaster in Regina, which caused the loss of some twenty-eight or thirty lives and an enormous amount of property has caused the entire Dominion to marvel at the wonderful resourcefulness of the civic authorities and citizens of Regina generally, but few, if any, outside of Regina, are aware of the almost superhuman work of a small number of men connected with the Saskatchewan Government Telephones. Mr. Warren, chief engineer for the Department of Railways and Telephones, arrived in Regina at 7 a.m., Monday, July 1st, the morning after the disaster, and at once proceeded to collect men and material necessary to restore the telephone service. The Telephone Exchange Building was completely destroyed as was also a large portion of the outside plant, large numbers of poles, wires and cables being down in the streets in a tangled mass. After securing temporary quarters in one of the new freight sheds, Mr. Warren started men at work installing a temporary six-position toll board which was arranged for Sunday night, also other men were put to work clearing up the line trouble on toll lines, while still others were stringing temporary cable from pole lines into the temporary quarters and two foremen with large gangs were clearing the wreckage of poles, wires and cables from the streets. At 7.30 p.m. Monday, the toll board with racks had been completely installed and all toll lines connected, there being some twenty-four lines the trouble in all of which had been cleared by this time. By 12 noon, Wednesday, July 3rd, a room which had been secured in the centre of the city had been equipped with eight booths or pay-stations and circuits from these were connected to the temporary toll board located in the north-west portion of the city. An emergency order for a switchboard of standard common battery type was placed with the Northern Electric & Manufacturing Company in Montreal and arrived in Regina Tuesday, July 9th. This equipment, which will give service to the entire city, will, it is thought, be in complete working order in the temporary building about August 1, it being necessary to change all underground and overhead cable so as to bring them into the temporary building which is located two blocks south of the old exchange cite.

Moose Jaw's New Plant

Following the disastrous fire which some weeks ago almost completely destroyed the power plant in Moose Jaw, electrical superintendent J. D. Peters has prepared a comprehensive report which will place the power plant of Moose Jaw on a thoroughly modern basis. The boiler house will be extended from a width of 72 to 100 feet, so as to permit the installation of economizers, providing for a total boiler capacity of 2,500 h.p. which, with the economizers, the superintendent calculates will carry peak loads of 3,500 h.p. The plans are so made that extensions, allowing the installation of an additional 4,000 h.p. boiler capacity, can be made.

An engine room 50 ft. by 86 ft. running parallel with the boiler house will be built. This building will provide for three generating units set on 25 ft. centres and leave sufficient space across the north end for street lighting station equipment, or other special apparatus. The main switchboard will be placed along the east side of this building at a distance of 8 or 10 ft. from the wall and the operation will be by remote control mechanically operated oil switches with duplicate bus-bars.

The two-phase system will now be replaced by three-

phase, and the city will probably undertake to replace the motors of their customers with three-phase machines, or at least will undertake a fair share of the expense involved. A 1,000 kw. turbo-generator at present on order will also be supplemented by a 500 kw. unit, consisting of a high-speed cross-compound engine, direct connected to a 500 kw. generator. Superintendent Peters states that he recommends this type of unit because the question of installing a steam heating system is now under discussion.

With reference to street lighting it is stated that all the station equipment for street lighting circuits, along with a number of the arc lights, have been destroyed, and it is recommended that a modern type of metallic flame lamp be installed.

On account of the necessity of rushing work, tenders will not be called for the construction of the power house, but the work will be carried on by the city under the supervision of the superintendent.

Medicine Hat Extensions

The city of Medicine Hat is expending the sum of \$60,000 on electrical extensions on account of the rapid increase in demand for power and electric light. Medicine Hat is developing very quickly in the manufacturing line on account of special power inducements the city is able to offer in the way of cheap gas and electricity. The new electric plant which was started up in September, 1911, is working satisfactorily, and daily increasing its load. The plant consists of two vertical 4-cylinder gas engines, each direct connected to a three-phase, 2300 volt, 170 kv.a. generator belted to excitors. The current is controlled and operated from a six-panel switchboard equipped with all the necessary modern instruments. At present there is a motor load of 180 h.p. on the line and applications have been received for an additional 100 h.p. from the Pottery plant, to be delivered about September 1st; from the Medicine Hat Milling Company for 75 h.p. for immediate delivery and for a further 100 h.p. to be delivered about the 1st of January. The Preston Planing Mills will take 75 h.p. also about the 1st of January and negotiations are in progress for the supply of a 200 h.p. block to another firm.

All the public utilities, such as the waterworks, gas and electricity are owned and operated by the city. The streets are illuminated by gas arc lamps, the cost of gas being extremely small, so much so, indeed, that the price for domestic purposes, such as lighting, cooking, and heating is only 13½c per thousand cubic feet and special rates lower than this figure are allowed for manufacturing purposes. All the public utilities are under the direct charge of Mr. A. K. Grimmer, city engineer, with whom is associated Mr. C. Brazil, city electrician, and Mr. G. R. Taylor, city electrical engineer, and superintendent of the power house.

Kenora

The Town of Kenora has placed an order with the Union Metal Company, of Canton, O., for sixty-five No. 5 Jandus Pressed Steel Luxolabras, which will be installed along the main street of Kenora. This is another evidence of the progressiveness of the western town, which is finding that, by illuminating their streets properly, they prevent crime, create business and give the stranger a good first impression.

The standards will be placed one hundred feet apart, the feed wires being run underground in fibre conduit. All

the poles of the telegraph and telephone companies are being taken off the main street and set back in the lanes, so that there will be nothing left on the main street but the ornamental lighting standards.

The standards will carry five lights, four of them of one hundred watt and the fifth of one hundred and fifty watt capacity. The whole five will burn until midnight, and the odd upper lamp until morning. Distribution is by the three-wire multiple 110 volt system, fed from pole-type transformers, placed also in the back lanes and controlled from the main sub-station.

Regina, Sask.

Though the rapidity with which the electric equipment in Regina was destroyed by the tornado was not equalled in the time taken to replace the system on an operating basis, it is sufficient to say that the light, power and street railway plants were operating satisfactorily much more quickly than was expected. The cyclone which struck the city at 5 p.m. on Sunday, June 30th, put the street railway completely out of business, all overhead gear being down in

a confused mass, from which it was estimated that it would take two or three weeks to get the railway running again. However, at two o'clock on the afternoon of the following Wednesday cars again made their appearance, and though it took a couple of weeks to get everything operating as before, the service in the meantime has been eminently satisfactory under the circumstances, and the new superintendent of railways, Mr. Sydney D. Egan, is to be congratulated on his excellent work.

The Regina Street Railway, which is owned and operated by the city, is controlled by a commission of two, Messrs. Thornton & Mantle, and superintendent Egan ex-officio. Ten miles of line are already in service, much of which is double tracked. Cars run from 6 a.m. till midnight, with no Sunday operation. Various extensions are in course of construction and are being carried out by the city under the supervision of the superintendent. One may judge of the financial success of this road, by the returns for the week ending June 29th, when 42,898 passengers were carried and the gross revenue amounted to \$1,908.25. This was an increase of \$182.50 over the previous week, with an increase in passengers carried of 5,411.

Vancouver and the Pacific Coast

New Telephone Cable Across Burrard Inlet

The British Columbia Telephone Company recently decided to lay a new submarine cable across Burrard Inlet connecting the cities of Vancouver and North Vancouver. This new cable which will extend from the C.P.R. wharf at the foot of Seymour street, Vancouver, to the Lonsdale avenue ferry slip, North Vancouver, will be some three miles in length, will contain 84 lines or 168 wires and will cost about \$50,000. The cable, second only in size to that connecting San Francisco and Oakland, and the largest in the Dominion, has been ordered from a British firm and is expected to arrive in Vancouver about the end of September. The original intention of the company when it was learned that the cable had to be removed from the First Narrows, was to lay a small line of 32 wires along the route now authorized by the government. The government refused to sanction this arrangement however, on account of the objections raised by shipping men who claimed that the cable would foul the claims of vessels while riding at anchor. A compromise was arranged when the company contracted to lay cable heavy enough to sink into the mud where it would do no damage, and would not be affected by the swift currents of the Inlet.

To Develop Power on Fraser River

The application of the International Railway and Development Company to store or pen back some 5,000 feet of water in the Fraser River above Yale, is understood to be merely a step in the operations of the company whose ultimate object is to construct a system of tramways throughout the lower mainland, connecting New Westminster with Ladner by a line along the dyke on the south shore of the Fraser, thence through Delta and Surrey to Blaine and east to Huntingdon. English capital is supposed to be behind the enterprise, in front of which stand Mr. H. T. Thrift, of Surrey, who is secretary of the company, Mr. E. W. Leeson, of Vancouver and Mr. D. F. McDuff, engineer. The charter was obtained from the B. C. government two years ago, and the Delta council was approached last May for permission to use the dyke. It is believed that this is the first application to dam the Fraser for developing power. The proposed location of the dam is 11,000

feet above Yale where the river rushes swiftly through a narrow channel.

British Manufacturers Entertained

While in Vancouver during the early part of July the visiting British Manufacturers were royally entertained by the B. C. Electric Railway Company. The company chartered a steamer and took their guests to Indian River on the North Arm of Burrard Inlet, afterwards proceeding to the B. C. Electric Railway Company's power house at Lake Buntzen. Here the visitors were shown over the generating station and also the site of the new one which will almost double the capacity of the existing station, when it is completed in the course of the next year. The visitors also inspected the 1,800-foot tunnel which will connect Lake Buntzen with the new station. All were greatly impressed with the vast development work here, and united in praising the company for the manner in which it had provided for the demand for electric current for public and private purposes throughout the lower B. C. mainland. A banquet was held on the night of the visitors' departure from Vancouver.

A Lineman's Contest

The B. C. Electric Railway Company gave a picnic to its employees on the Southern mainland of B. C. at Hastings Park, Vancouver, July 24 and 25. Sports were held on both days, and a number of challenge cups presented for competition between the Vancouver and New Westminster staffs. Numbered among the various events was a lineman's contest during which each competitor climbed a 40-foot pole, placed an insulator, and returned to the ground. To commemorate the occasion the company presented each employee with a handsome bronze watch fob.

Attended N.E.L.A. Convention

The following members of the B. C. Electric Company attended the N.E.L.A. Convention at Seattle June 11th to 14th:—R. H. Sperling, General Manager; Geo. Kidd, Comptroller; C. Rummel, Manager Light & Power Department; Jno. Jenkinson, J. B. Ingersoll, Jno. Priestman, K. B. Ryan,

J. Munro, E. Rogers, F. J. Jordan, L. Davies, K. A. Auty, Jas. Kerr, A. G. Perry, M. K. Ney.

Among other representatives of Vancouver were noticed: W. T. Woodroffe, city electrician; F. Nimms, Western Canada Power Company; S. B. Smith, Hinton Electric Company; Mr. Reid, Canadian Westinghouse Co.; Mr. Wycle, P. Burns & Co.; Mr. McCrea, Pacific Electric Heating Co.; Mr. B. Holtz, Northern Electric & Manufacturing Co.

Officials Inspect Waterworks Intake

The new Westminster civic officials recently paid a visit to the Coquitlam dam for the purpose of inspecting the new waterworks intake which the B. C. Electric Railway Company is providing for that city. The company's expenditure at the dam in connection with the New Westminster water supply system totals \$1,000,000. Of this sum \$250,000 has been spent on the construction of the intake tower and tunnel to the main, and \$750,000 on clearing operations, the requirements demanding that the entire shore of the lake be cleared of all undergrowth to a height of 60 feet above the present level, thus laying bare all the area which will be flooded. At a luncheon held at the company's club-house at the dam the New Westminster authorities expressed great satisfaction with the provisions made by the company in connection with the city water supply.

Kootenay Power and Construction Company

Mr. J. B. Ingersoll, electrical engineer of the B. C. Electric Railway Company, Vancouver, has resigned and leaves shortly to take charge of the work of the Kootenay Power & Construction Co., which is constructing an hydraulic plant at Kootenay Falls on the Kootenay River, Montana state. The plant is planned to develop 40,000 horse power. Mr. Ingersoll will have charge of the installation of the plant as well as the construction of 170 miles of transmission line. Mr. Ingersoll only became connected with the B. C. Electric Railway Co. about one year ago, having been previously employed by the Spokane and Inland Empire Railway Co. In his new position he will be located at Spokane, Wash.

B. C. E. R. Main Street Extension

The B. C. Electric Railway Company is constructing an extension to its Vancouver sub-station on Main street, replacing the temporary structure now on the site. The new building will be of brick and terra cotta, two storeys in height. The transformer room is to be located on the ground floor, and the meter inspection rooms, etc., on the upper floor. The foundation of the building will be made sufficiently strong to carry a five-storey building, as it is intended to place additional storeys as the needs of the company develop.

W. C. P. Co. Will Install Two More Units

The Western Canada Power Company, whose present installation at Stave Falls, B.C., has a normal capacity of 25,000 horse-power, have definitely decided to proceed with the installation of two additional units of 12,500 horse-power each. The company have at the present time contracts for over 18,000 h.p. and about 18,000 additional are under negotiation.

Telephones

Representatives of the B. C. Telephone Company recently investigated the advisability of making an offer for the plant of the Farmers Mutual Telephone Company at Sumas, Southern B. C. The result of the negotiations has not yet been made public.

The Government Telephone Service expects to have the new metallic two-wire copper telephone line in operation through Kelowna, Peachland, Summerland and Penticton during the month of September. At present the line runs south as far as Kelowna. The new cable to cross Okanagan Lake has arrived at Summerland, and poles are now being prepared and gang lines organized to erect the poles and run the new wire.

Victoria City Lighting

The illustration shown is a view of one of Victoria city's well lighted streets. To date this city has 600 ornamental standards installed, which number will be increased to 1,600 as early as possible. The style being used is cast iron five-light standard, placed 80 feet apart with one post on each corner at intersections. The lamps are low voltage type, being 8 volt, 50-watt tungstens, enclosed in 12-in. frosted

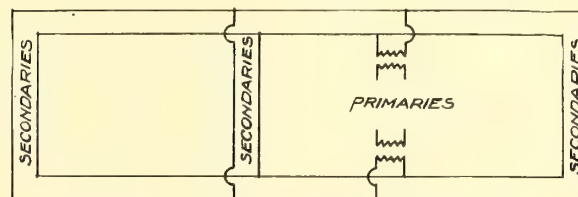


globes. All lamps burn till midnight and alternate standards all night. Energy is purchased from the B. C. E. R. Co., from their hydro-electric plant on the Jordan river, where there is sufficient power for an ultimate installation of 40,000 h.p. capacity. The distribution service is underground throughout and is paid for on the local improvement basis by the property owners in proportion as they benefit.

Questions and Answers

The following question has been received from a reader of the Electrical News. We shall be glad if any of our subscribers will submit answers that will assist in the solution of our correspondent's difficulties:

Q.—Fourteen years ago I put up a circuit, of which I enclose a diagram, and connected two transformers in mul-



multiple to feeders. Everything ran well since that day until the other night when on going to start up for the evening run there was a short-circuit on the secondaries of those transformers. On investigation I found they were not burned out and that by disconnecting one the other would light up the circuit, but, as soon as the other was connected in, the short was there again. As an experiment I reversed the secondary connections when the short circuit was gone.

W. H. B.

AUGUST 1912

The Construction of Distribution Systems

For Outlying Districts and Small Plants—Many Useful Hints for the Distributing Engineer

By Mr. S. Bingham Hood.*

In establishing an electricity supply service in villages, or the more or less scattered population surrounding our larger cities, the problem becomes much more complex, both commercially and electrically, than that of the supply within the city itself. Most of the earlier small systems were constructed in a crude makeshift manner and gave at best anything but what we class to-day as reliable service. The men who financed these small plants seldom had any electrical knowledge, and frequently operated the system as a side line to their regular business—the power plant being located in some local mill or factory with the idea, generally, of using the prime mover for factory operation during the day and making it work overtime to earn its salt by driving a small generator at night. The operator of the plant, a local jack of all trades, attended to inside wiring; did the construction work on the lines; installed, read and repaired the meters (unless it was a flat rate proposition); and in his spare time operated the plant. The natural result was generally that, where the system was growing, he had no time to attend to operating duties and the service became unreliable in proportion to its prosperity—at least until such time as the unreliability overshadowed the prosperity and the whole undertaking went on the rocks. This was the favorite time for the big fish to swallow the little one and has resulted quite generally in the present-day suburban systems being owned and operated by the large system of the nearest city, the local plant under these conditions being abandoned and supply obtained from the large central station.

The result of this has been of great benefit to the local suburban community, in that they not only obtain the primary supply from a modern station giving the highest class of service, both as to reliability and efficiency, but also have at their command a skilled, specialized force to design and supervise the local distribution and operation.

To successfully and profitably operate a large scattered suburban load the construction of the distribution system must be the very best that can possibly be obtained in order that an uninterrupted service may be given. This requirement is even more imperative than in the larger community, as the suburban system must to a considerable extent be automatic in its operation owing to the difficulty, time, and expense necessary to restore interrupted service due to line failure at points remote from the operating headquarters. Combined with this requirement the annual overhead charges must be kept as low as possible to make the distribution profitable. These annual charges reach a minimum where the design and construction of the distribution system is such that a maximum life is obtained with a minimum capital expenditure. Failure to realize this point was the downfall of the early systems where every effort was made to "make it cheap," with the result that the life of the system was limited to but a few years. At just what point maximum efficiency results is hard to determine. Local conditions may make a design adapted to one locality an expensive one for another. The best materials may be selected to cover the mechanical construction, but an electrical system may be adopted which may be so expensive that the combined cost becomes prohibitive. Generally speaking, however, maximum economy has been reached where the interest charges, equal the charges for depreciation. In other words, the cheaper you can get your money the more you

can afford to spend to lengthen the life of the distribution system.

In addition to this the first cost of current plays an important part. In water power plants or large turbine steam plants the cost of current at the bus-bars is very low, and, consequently, the line losses in transmission may be made somewhat high to advantage, particularly in suburban work where the load factor is generally low. Right here, however, a word of caution is opportune. You can make your line losses between the source of current and the point where first load is taken off anything within reason—but between the nearest and farthest load your total drop in pressure, including both primary and secondary, as well as transformer drop, must not exceed five per cent. if you expect to give service in its true sense. You can't operate a feeder with a drop of anywhere from ten to twenty-five per cent. and start loading it at the city limits and leave off at Farmer Jones', half a mile beyond the next village. We all know this, but still seem to keep on trying, with results similar to our railway friends in their efforts to eventually make a single track line operate successfully without sidings.

The Cost of Construction

If we analyze the cost of suburban transmission we find that the pole line (such systems being nearly always overhead) represents the greatest proportionate investment. We also find that this portion has to carry the larger share of the depreciation, due to its limited life under ordinary conditions. Let us therefore take up, first of all, this part of the work and endeavor to show where maximum economy can be obtained. In suburban and semi-suburban work a thirty-foot pole line is amply high enough where the run is free of trees or other obstructions. Special cases will, of course, require higher poles, but the average condition is covered by the sizes shown in Table 1. The prices here apply to average conditions of labor and material costs in the vicinity of our larger cities.

The cost of pole in the rough is that of good clear B. C. cedar, with an increase in diameter of one inch for every ten feet. The cost of shaving, framing and treating covers shaving from ground line to roof, taper or wedge roofing, cutting and boring of gains and boring for steps and sockets. The treating, where same is included, consists of a double immersion of the butt to one foot above ground line in carbolinum oil; first immersion to be in hot oil and second in cold.

Painting is for one coat, in pole yard, of entire pole above ground line; this coat preferably to be of a light body paint or stain, such as shingle stain, which will penetrate into the surface for an appreciable distance. The object of painting is primarily to improve the appearance of the pole, as any pole line is objectionable from the public's standpoint and anything that renders it less so is a first class investment. In addition, a coat of stain undoubtedly does act as a preservative to a considerable extent. The object of stepping and socketing the pole is also to prevent its being cut up by continual climbing with spurs which not only spoils the appearance of the line, but leaves countless little holes or pockets to collect water and drain it right into the heart wood of the pole. Steps are, or should be, standard $\frac{5}{8}$ -in. by 9-in. hot galvanized and have a life far beyond

* Presented at the C. E. A. Convention.

that of the pole in which they are to be used. The best form of socket is a malleable iron or wrought iron thimble which will drive into a $\frac{7}{8}$ -in. hole. The hole in thimble will take a $\frac{1}{2}$ -in. lag screw or pin which is slipped in by the lineman when about to climb a pole, and taken out when he comes down. Four of these sockets are required for each pole, making the first step come seven feet from the ground. As the sockets are not readily removable after once driven, their life is, of course, that of the pole in which they are placed.

The cost of setting given in the table is that for average digging in hard clay or loam. This column for items 9 to 14 is original cost of setting plus the cost of cutting off, digging out old butt, and dropping down and retamping the balance of pole.

The life of pole is taken as that where the butt rot at ground line has decreased the sound diameter to that of the

average of these annual costs, which is \$1.84, and eliminating all above the average we have the following to select from:—

	Cost.	Annual Charge.
30 ft. x 6 in. treated	\$10.56	\$1.49
30 ft. painted steel	21.65	1.62
30 ft. galvanized steel	18.15	1.63
35 ft. x 7 in. treated, brush re-treated and reset	19.07	1.65
35 ft. x 7 in. treated, re-treated and reset	20.17	1.67
30 ft. x 7 ft. treated	12.64	1.69
35 ft. x 7 ft. treated and reset	18.47	1.71
35 ft. x 8 in. treated and reset	20.21	1.76
35 ft. x 7 ft. treated	14.47	1.84

It is interesting to note that no untreated pole comes below the average. The 30 by 6 appears to be the winner, al-

TABLE I
INVESTMENT AND ANNUAL COST ON POLES.

ITEM	SIZE AND KIND	COST IN ROUGH	SHAVING FRAMING TREATING	HAULING	PAINTING AND STEPPING	SETTING	TOTAL	LIFE (YEARS)	ANNUAL COST
1	30' x 6' PLAIN	\$ 3.05	\$ 1.10	\$ 0.45	\$ 1.35	\$ 3.50	\$ 9.45	6	\$ 2.05
2	30' x 6' TREATED	" 3.05	" 2.20	" .45	" 1.35	" 3.50	" 10.55	11	" 1.49
3	30' x 7' PLAIN	" 5.00	" 1.10	" .45	" 1.39	" 3.50	" 11.44	7	" 2.21
4	30' x 7' TREATED	" 5.00	" 2.30	" .45	" 1.39	" 3.50	" 12.64	12	" 1.69
5	35' x 7' PLAIN	" 6.00	" 1.30	" .48	" 1.64	" 3.75	" 13.17	8	" 2.30
6	35' x 7' TREATED	" 6.00	" 2.60	" .48	" 1.64	" 3.75	" 14.47	13	" 1.84
7	35' x 8' PLAIN	" 7.50	" 1.30	" .48	" 1.68	" 3.20	" 14.75	10	" 2.21
8	35' x 8' TREATED	" 7.50	" 2.75	" .48	" 1.68	" 3.80	" 16.21	15	" 1.89
9	35' x 7' PLAIN + RESET	" 6.00	" 1.30	" .68	" 1.84	" 7.35	" 17.17	15	" 1.89
10	35' x 7' TREATED + RESET	" 6.00	" 2.60	" .68	" 1.84	" 7.35	" 18.47	20	" 1.71
11	35' x 8' PLAIN + RESET	" 7.50	" 1.30	" .68	" 1.88	" 7.40	" 18.76	18	" 1.87
12	35' x 8' TREATED	" 7.50	" 2.75	" .68	" 1.88	" 7.40	" 20.21	23	" 1.76
13	35' x 7' TREATED RETREATED + RESET	" 6.00	" 3.80	" 1.38	" 1.64	" 7.35	" 20.17	25	" 1.67
14	35' x 7' TREATED BRUSH RETREATED + RESET	" 6.00	" 3.60	" .48	" 1.64	" 7.35	" 19.07	23	" 1.65
15	30' STEEL POLE PAINTED	" 8.75		" .40	* 7.50	" 5.00	" 21.65	30	" 1.62
16	30' STEEL POLE GALVANIZED	" 12.75		" .40		" 5.00	" 18.15	25	" 1.63

* EVERY 3 YEARS

top of pole. This life varies widely with different conditions of soil, climate, etc., but figures given represent a fair average. For treated pole the life is uncertain owing to lack of definite data. The writer has taken the increased life as being five years for a pole with 7-inch top, as poles so treated have been under observation for this length of time and some are starting to show signs of decay, while others are as good as the day they went into the ground. Where this decay has started there is no means of telling whether it is going to be the same as an untreated pole, or faster or slower. Five years increased life is, therefore, taken as the known increase.

Table 1 shows sixteen sizes or combinations of poles suitable for suburban or semi-suburban conditions, fourteen of which are wood. In figuring the annual costs it is assumed that the value of pole will be entirely wiped out at expiration of given time. The steps can probably be used over again and the pole may have a slight resale value, but these at best will only cover removal costs. It will be noted that while the investment costs vary by over 100 per cent. the annual costs only vary about 35 per cent. Taking the

though such a pole is hardly strong enough for supporting transformers, corner poles, etc. Assuming that every fifth pole should be 7-inch top we get an average cost per year of \$1.53. This clearly shows that butt treatment is a great economy, and if such treatment should turn out to give a life as long as the makers of the carbolinum claim, the economy will be very much greater. For this class of work the writer recommends the use of 30-foot treated poles for branch secondary lines, using 6-inch for straight runs and 7-inch for strains and corners. For trunk lines requiring primary wires a 35-ft. pole should be used, 7-in. tops meeting all usual requirements. While the table gives the annual cost of such a pole as \$1.84, the actual cost with above suggested arrangement is less owing to our having a good, framed, 30-foot pole left from the old 35-ft. when it requires renewing at the end of 13 years. This brings the annual cost of the 35-foot pole down to \$1.33 or less than the 30-foot poles. This saving would, however, not be possible unless we used 30-foot for standard branch lines, as otherwise the old cut-off 35-foot poles would be dead wood on our hands.

The theory of wood preservation must be clearly understood by those attempting the treatment if success is expected. Wood rot is caused by a living microbe, and, to sustain life we must have all of three things—light, air and water. Each one of these microbes throws a tendril or thread to the point where all three of these conditions exist, and these tendrils may be many feet in length, as they are in the case of dry rot, or heart rot. Deprive these organisms of any one of the three essentials to life and we have solved the problem of preservation. If we keep our pole above ground in condition to shed water, by filling all exposed end grains and preventing damage to the exterior surface, we have eliminated water from this part of the pole and insured against surface rot. A short distance below the ground line both light and air are eliminated, so that our danger zone is confined to a few inches above the ground and from one to one and one-half feet below the ground. It is this portion which requires preservative treatment and any compound which will permanently exclude the air fulfills the purpose. It is not necessary that this extend entirely through the pole as the organism in going down through the heart can not obtain light and can not live. The only really successful compound for this purpose appears to be some of the coal tar by-products, of which the dead oil, known to the trade as carbolinum, appears the best. A brush treating process can meet with but indifferent success owing to all timber being more or less filled with season cracks or checks, the interior of which can not be reached with a brush. The immersion treatment requires two open tanks, one hot and one for cold oil, each capable of holding eight or ten poles, which are hoisted by a derrick and their butts set vertically in the tank. In addition a storage tank is desirable and a small circulating pump with suitable piping and valves connecting all three tanks. For heating the oil a furnace may be built under the hot tank, or better still, a small steam boiler provided and steam coils immersed in the tank. Where current is readily obtainable the heating can be done conveniently by means of low pressure resistance coils placed directly in the bottom of the tank, a suitable grid being placed to keep the weight of poles off the coils. Such an equipment should be installed for from \$2,500 to \$2,000, and will pay for itself in a very short time.

The growing scarcity of timber suitable for poles is rapidly forcing up the price until it seems a few short years will make it necessary for us to use some other material with which to support our overload lines. For voltages between those that can be handled with bare hands and those too high to handle alive, a wooden or other form of insulated pole has its advantage. For high tension transmission and for low tension secondary distribution, however, a metal pole has no objectionable features. It would seem, therefore, that we should conserve our remaining forests for use where wood is advantageous, and substitute some other material for the balance of our requirements. The past few years have seen many improvements along these lines, steel towers for transmission lines being used to-day almost exclusively. For trolley systems the tubular iron pole has been in use for urban lines for many years. Reinforced concrete has also been tried with varying success and gives promise of ultimately being successful.

The Concrete Pole

The concrete pole has been adopted for all secondary distribution by one of our larger Canadian cities, and we can well afford to wait and see how these work out before

experimenting ourselves to any great extent. These poles are from 25 to 30 feet in height, of square section with beveled corners. They run about six inches at top and eight to nine at the butt. Re-inforcement is with four one-half inch rods, one in each corner, about one inch from the surface. The cost in position is about the same as that of a treated cedar pole, and, theoretically, there should be no limit to their life. Personal observations, however, precludes their being recommended by the author. It is surprising the amount of rough handling these poles will stand and the extent to which they will bend without breaking. The peculiarity seems to be their failure after they are in position and the wires in place. Where they can be head guyed so that practically no strain is placed on them they work admirably considered simply as props, with a vertical load only. Two forms of failure have been noted. First, where the head guy has given and allowed a strain to come on the pole; in this case the beam has its fulcrum at the ground

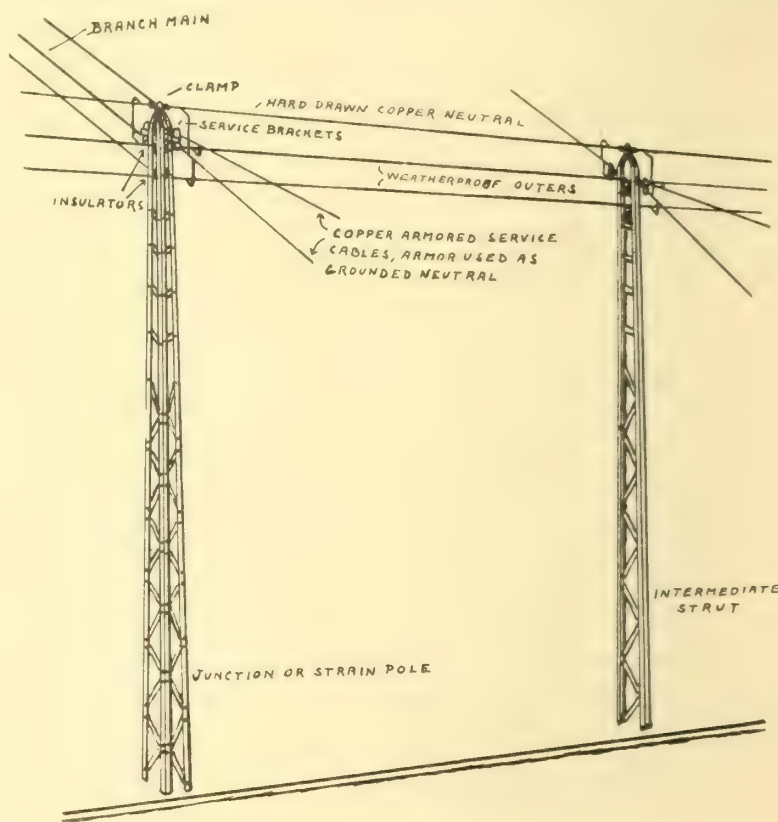


Fig. 1.—Steel pole secondary distribution.

line and a tremendous leverage takes place, which draws the re-inforcement on the side under tension right out of the concrete. This could be overcome by fastening the lower ends of the re-inforcing rods in some kind of a plate, but would probably result in the strain breaking the rods instead of pulling them out. The other failure appears to be due to a torsional strain from uneven balancing of the wire pull at the top. In this case the outer shell of concrete near the top is entirely broken off and the rods with the concrete core piece twist around until the strain is equalized. On straight runs they may prove successful provided the use of numerous anchor guys is not objectionable; but in taking off service lines serious difficulties come up, as it is hardly practicable to side guy every pole where a service line is required.

Another apparent inherent defect in these poles seems to be the shrinkage cracks in the concrete. In many cases these are quite prominent and extend over three sides of the pole, being very pronounced on the side opposite the strain. It is very evident that the reinforcement is carry-

ing all the strain and equally evident that water is getting at the rods, as well as air. As to just what effect this is going to have on the life of the pole time alone will tell.

The writer's idea of what would be a successful reinforced concrete pole would be to have a circular cross-section, the reinforcement to be in the form of a tapered tube of either expanded metal or electrically welded mesh. To avoid deterioration this could be hot galvanized as a whole at small expense. The concrete would be moulded around this tube, which should be covered not less than one and one-half inches. To lighten the pole and save concrete a tapered mandril about two inches smaller than the inside of the reinforcing tube could be placed in the mould and withdrawn after the concrete had partially set. A pole of this kind would require pouring with the mould set on end, the entire proposition of development being one almost too great for any individual company to handle alone. Some of our enterprising manufacturers will, no doubt, eventually take up the development of such construction and put it in commercial shape.

Iron and Steel Poles

Tubular steel poles up to 30 feet are now a standard product. A pole of this height and heavy enough for distribution strains can be set in concrete at a cost of about \$30 each. Where provided with a reinforcing band at the ground line and the concrete carried up sufficiently above ground to act as a water shed the life should be at least 25 years. With this life and allowing for its scrap value the annual charge would be \$2.46, or about two-thirds greater than for a wooden pole. At the rate the cost of timber is going up a few years will put iron and wood on an equal footing for such use.

Structural iron poles can be developed easily along the same lines as standard transmission towers, but on a smaller scale. One company is now making a light three-legged tower at very moderate cost and numerous designs could be brought out using galvanized standard shapes and giving a pleasing appearance with ample strength. A built up pole can be made at a cost in position not exceeding twenty dollars. The life should be at least twenty-five years with an annual cost of less than \$2.00 or a little greater than a wood pole line. In fact, the writer has in mind at the present time a system of construction in which about every fifth or sixth pole would be of the tower type, Fig. 1, the intermediate poles being simply latticed struts set to take up a right angle strain due to service lines. The tops of these poles would be solidly connected by a hard-drawn copper wire which would act as a stay wire, and also a grounded neutral for the distribution system. The annual cost per pole for this idea will run approximately \$1.60, or about the same as the wood pole line. These costs can probably be further cut down by bolting new ground sections to the old poles at the expiration of the original life, as little or no depreciation should occur above the ground if four test galvanizing is insisted upon.

Pole Fittings and Hardware

The permanency, reliability and overhead charges of a distribution system depend probably more on the hardware and fittings used than upon any other item of construction. In the days of early development very light poles were the rule and their life was generally not over five years; consequently, any fitting which would last as long as the pole was considered good enough.

With the adoption of a treated pole giving a life of twelve years or more very different fittings are required. For high tension lines, or those of over 600 volts, the wooden cross arm is probably the best means of supporting the wires, as its insulating qualities are of considerable advantage. Cross arms of standard dimensions as specified in the overhead line committee's report of the National Elec-

tric Light Association, together with the hardware for cross-arm attachment as specified in this report, should be used by all electrical distribution companies where the wires are supported on cross arms. The standard sizes are not only those which practice has shown to be suitable for the work, but, even with the greatest care, accidents are bound to happen and an acknowledged standard method of construction is of considerable advantage in defending a lawsuit.

The ordinary cross-arm, however, even where of standard dimensions, is not good enough for use with treated poles unless specially selected and treated. An exception to this may possibly be made if the arms are of genuine hard yellow pine. This grade of wood is expensive and very heavy to handle, and, while strong, is not nearly as strong as its weight would seem to indicate. The softer woods, such as stock arms are generally made from, are absolutely worthless unless treated. These arms generally show heart rot first, and may appear perfectly good on the outside and actually be but a shell, which indicates that the weak point is the exposed end grain in the pin holes. To overcome this it naturally follows that any method of treatment must be before the pins are inserted and also that a brush treatment is useless. For treated cross-arms straight grain clear spruce is without doubt the best material. Arms of this wood are very light and exceedingly strong and tough for their weight. If treated with carbolinum oil the wood should be first kiln dried and then immersed in the hot oil until it refuses to absorb any more, several successive baths being given, the final one in cold oil. The best treatment for cross-arms is, however, that of "Kyanizing," in which the timber is rendered absolutely sterile and will give a life of twenty years or more under most severe climatic conditions. Kyanized timber is to all appearance the same after as before treatment, and must be painted to give a good appearance if used in built-up localities as in villages or towns. A Kyanized spruce arm will cost approximately 50 per cent. more than the common stock arms, but, when it is considered that it has from three to four times the life, it becomes an excellent investment, particularly when it is considered that the labor cost of changing an arm may exceed the actual cost of the arm itself. For pinning cross-arms only locust pins should be used and only those with 1½-inch shanks. Oak pins are just about as treacherous as stock cross-arms as they rot off at the shoulder in a short time. When it is considered that a broken pin may cause an interruption to an entire distribution system, and that the proportionate costs of the pins in comparison with total cost of the line is infinitesimal, any attempt at economy on this article is worse than poor engineering, and is, in fact, criminal if the pole line is on a public highway. For the same reason, too much dependence should not be placed on a single pin, and double arms should be used at all angles and junctions, and, preferably, also on the first pole on each side of a strain pole. These double arms should be provided with two spacing or spreader bolts in addition to that holding the arms in position. Various forms of spreaders have been tried out from time to time, but the writer has found the best form to be a wood block with a transverse hole to receive a standard through bolt. These blocks are frequently made in the field from a section of standard cross-arms, but a far better practice is to have them made from 3-inch by 4-inch surfaced stock, treated the same as the arm. The blocks may be made in lengths of from 18-inch to 24-inch, and can then be cut to proper length as required, the 11/16-inch hole being bored through the entire block at the mill.

Locust wood suitable for pins is becoming so scarce, and, at best, a wood pin is the weakest point in our suspension system, that metal reinforcement or entire metal pins are being used more and more as the demand for permanent

construction increases. These pins range all the way from the ordinary wood pin with a $\frac{3}{8}$ -inch iron rod inserted in it to the all-metal pin. Attempts have been made to standardize a metal pin of malleable iron having a $1\frac{1}{2}$ -inch shank to fit the old style of arm; this style has not found favor, however, owing to the arm then becoming the weakest point. Malleable pins have also been found objectionable owing to the tendency to split the insulator due to unequal expansion between the iron and the glass or porcelain. In order to overcome this, metal pins with wooden tops are used extensively, the common form being simply the old wood pin cut off at the shoulder and bored to receive a $\frac{1}{2}$ -inch carriage bolt. A similar style uses only the threaded portion of wood, the base being a porcelain spool which slips over the bolt. Probably the oldest style of metal pin is the Western Union, which has been standard for many years with telegraph companies. This pin has not, however, the necessary stiffness for electric light work.

Metal Pins Best

The best metal pin designed to pass through the arm is undoubtedly a design which has been placed on the market within the past year. This is of high carbon steel with bolt $\frac{1}{2}$ -inch in diameter. The shoulder is increased in diameter and drawn square, which not only stiffens the pin, but provides a wrench hold. The contact point with the arm is swaged out to form a good-sized shoulder, and the insulator thread is formed of a steel wire spiral which slips around in the insulator thread when expanding and contracting. This absolutely prevents insulator breakage and also that very annoying tendency of insulators to unscrew and become loose on the pin. These pins cost about three times that of a locust pin, but are an excellent investment, as, being hot galvanized, there is practically no limit to their life, and, while they may be bent, they will never break and drop the line. Another feature that makes them an economy is the small amount taken out of the arm for the pin hole. A wood pin leaves only 2 inches of wood out of a total of $3\frac{1}{2}$ inches, while the steel pin leaves 3 inches, or fifty per cent. more, which not only adds to the strength of the arm, but also materially to its life. For heavier strains the same makers have recently brought out a clamp pin made of a bend of $\frac{3}{4}$ -in. channel. A U bolt of flat steel is used to clamp this to the arm, and the insulator support is the usual steel spring thread pin. Such a method of fastening effectually does away with any possibility of the arm splitting and for heavy or important feeder lines makes an excellent job at very moderate increase in cost, the pin and clamp averaging complete about twenty cents.

For dead ending a line, particularly with large wire, the best pin made is an unsafe proposition and for such use some form of strain insulator with bolt right through the double arms should be used. The writer has not located, to date, a device which can be purchased in the open market and which meets the requirements. We are using, however, a malleable iron elevis adapted to take a standard $\frac{5}{8}$ -in. bolt and using a porcelain spool insulator held in position by a $\frac{5}{8}$ -in. pin with cotters in each end, Fig. 2. These can be made up cheaply in any shop and make a dead end that can't get away. We also use a $\frac{5}{8}$ -in. eye-nut where it is desired to head guy the arm, this placing no strain on the arms other than actually holding up the weight of the line.

The balance of pole hardware is now standardized, but, above, all, should be hot galvanized only; plain iron for bolts or braces is both an expensive and dangerous proposition for use with treated poles, as they will not outlast the pole which should be the first part of the line to give out from age.

For taking off services and branch lines we are all fa-

miliar with the wooden side block and the reverse or buck arm. For junction poles at important corners the latter may be necessary, but for other places either is such an eyesore that their use should be condemned in the strongest terms. For this purpose some form of metal spreader bracket should always be used. Various styles of malleable iron brackets have been on the market for years, but have defects which are too well known to need mention here. Fortunately it is now possible to obtain a full line of wrought steel brackets to meet every possible need. These are unbreakable, of light weight, and have a spring thread similar to the metal pins mentioned above. As the heaviest pattern of three-pin brackets costs only about one-half dollar, and a light two-pin about 20 cents, the cost is low enough to make their use general. For attaching to buildings the same line of brackets is available, together with a number of other styles adapted to building use only. With such fittings available there is no longer any excuse for



Fig. 2.—Dead ending clevis.

unsightly and slipshod methods of taking off or attaching service leads.

A method of running secondary distributing mains which is finding favor within the past few years is that of dispensing with cross-arms altogether. The three wires of the system are carried in a vertical plane on brackets fastened directly to the pole. A three-pin metal bracket for this purpose will cost erected about 50 cents, which is less than the cost of a cross-arm. With this method of suspension the lines can not swing together, and, consequently, can be placed on very short spacing, decreasing the inductive drop on a.c. lines. A further advantage of this method is the ability to take off service lines directly from the line pins without crosses in the line. For dead ending these lines a three-spool insulator bracket is used, secured to the pole with two $\frac{5}{8}$ -in. through bolts, forming an anchorage which will stay as long as the pole holds up. As we have a number of 500,000 c.m. mains carried on this type of bracket some idea of their strength can be realized. A vast gain in appearance can be made with this type of construction in comparison to the old cross-arm method.

Joint Poles

Before going into the question of wires a few words on the subject of joint poles may be opportune. Aside from the beneficial effect of minimizing the number of poles

on the highway, as regards public opinion, the joint use of poles offers great economy both as to first cost and upkeep expenses. The telephone or telegraph is found practically every place where electric light or power is required, and there is no valid reason why both classes of public service companies can not beneficially co-operate to utilize each other's investment to the maximum. Where both systems are on the same street, as they must be to supply service, there is always the chance of the two systems becoming crossed owing to falling wires. This is equally true irrespective of whether they are on separate pole lines or on a joint pole. For ordinary distribution under suburban conditions of load density a pole heavy enough to properly carry either system will just as safely carry both. This is due to the strength of a pole, considered simply as a prop, being far greater than the maximum load it must bear. With the wires and services of two systems on the same pole the bracing effect would be materially greater than where each system has its own pole line. With up-to-date construction where the lighting secondaries are carried in a vertical plane on brackets and the telephone is either lead cable carried on a messenger wire, or drop wire carried in rings for short branches, the appearances of the line can scarcely be considered as an objection beyond that which is an unavoidable evil made necessary by advance in our civilization.

A Clear Saving

From the financial standpoint we will assume for argument that the one company selects as a standard a 30-foot by 6-inch treated pole costing \$10.56 in position and having an annual charge against it of \$1.49. The other company must cross and re-cross the first line and finds these conditions require a 35-foot pole with 7-inch top, costing \$14.47, and having fixed charge of \$1.84 per year. The total expense to both companies is then \$25.03 per pole with a total annual charge of \$3.33. The average charge would then be \$12.52 and \$1.66 respectively. Now, the joint pole line proposition, using the 35-foot by 7-inch pole, would only cost each company \$7.24 capital expenditure and \$0.92 annual charge, a clear saving to each of about 42 per cent. in investment and 44 per cent. fixed charge. In actual practice it is not necessary or desirable to have any real joint ownership. All that is required is a working agreement between the companies, giving the methods of construction necessary to make a uniform standard, and some provision as to notification when one company desires to utilize a pole belonging to the other. Having such an agreement compensation can be based on a yearly rental. By referring to Table 1 it will be at once evident that, under ordinary conditions of suburban distribution a rental of one dollar per pole per pole would average about right and require little or no book-keeping to keep the accounts straight. It is fair to suppose that, where true co-operation exists, as it should, each company would use the other company's poles about equally, so that any excess or deficit in the rentals would be wiped out by the law of averages. Indeed, were it not for the standing given any joint pole agreement due to a definite compensation being established, there would be no real reason for establishing any charge whatever between the respective companies.

Having selected the various fittings which combine to form a uniform method of construction the actual running of a wire is a simple matter. Any economy to be gained here is largely due to the selection of a distribution system adapted to the requirements of a load to be served. As to the kind of wire to use, copper is the only choice. Aluminium wire may afford economies for transmission work, but for ordinary distribution it is unsuitable owing to the large span dip necessary to avoid overreaching the tensile strength of this metal. This extra dip would usually mean a higher pole, the cost of which would offset the saving in metal.

In addition, aluminium, owing to its light weight, and greater area for same conductivity, will swing and whip around in a wind to an extent that introduces all kinds of complications where space will not permit wide separation of the conductors.

The Choice of Cycle

For suburban distribution we need consider only a.c. systems. The frequency is based upon that of the generating plant from which primary energy is obtained. This is generally already fixed before local distribution is considered and may be anything from 25 to 60 cycle. For lighting 60 cycle has undoubtedly some advantages, but the idea that frequencies as low as 25 cycle are impractical for this purpose is entirely in error, provided your generators have a wave form approximating a smooth true sinusoidal curve. Low wattage metallic filament lamps show a very bad flicker on frequencies below 30, but it is so easy to educate the public to the use of higher candle power units for the economical lighting of rooms, in preference to several small units, that this objection is not serious. In lighting large areas indoors, for amusement places principally, where large numbers of small units are used, the "25 cycle flicker" is very pronounced as soon as the illumination exceeds a certain critical point. In this case the flicker should be welcomed as a warning that the bounds of good illumination are being exceeded, the flicker being a sure sign, if noticeable, that the eye of the observer is under undue strain owing to excessive amount of light entering the retina and, consequently, is unable to adjust itself to the variations in intensity between cycles. For arc lighting low frequencies are objectionable, but as the arc for interior illumination is now practically obsolete, having been replaced by tungsten clusters with greater all round reliability and efficiency, low frequencies do not introduce serious complications here either.

Taking all these points into consideration there is no reason for complicating the system by introducing frequency changers. If the frequency is not already selected and rotary converters are not intended to be operated on the system to any great extent, then 60 cycle is probably the best standard to adopt. If the bulk of the output will be used for power purposes then a lower frequency may offer some advantages, and, for American practice, 25 cycle would be the standard. Unfortunately this particular frequency does offer some slight disadvantages from a lighting standpoint, as mentioned above. Experiments have shown, however, that just slightly above 25 cycle these defects disappear. With this in mind a running frequency of about $27\frac{1}{2}$ is a marked improvement and can be obtained by simply running standard 25 cycle apparatus proportionately overspeed.

For the generating equipment there is no question but that multi-phase current is necessary. This may be either two or three-phase with the latter far in the lead as regards efficiency of distribution. For this reason only the three-phase system will be considered. This system is commonly operated delta connected, but of late years the star connection is finding more and more favor where distribution networks cover large areas. In fact, the writer ventures a prediction that the next decade will see all our systems operated star connected with a solidly grounded neutral. If we stop to consider that, under operating conditions, our insulation strain is nearly always that between phase wire and ground, and not that between wires, it is at once clear that operating at only 58 per cent. of the voltage which our insulation is designed to stand is pretty poor economy. We can reconnect the same apparatus in star and operate the same line to transmit three times the power. In order to operate successfully in this manner it is imperative that the neutral points of the star be solidly grounded, not only at the ends, but at frequent intervals

on the line. With this grounding there will always be more or less earth current which may cause interference with adjacent telephone or telegraph companies, to minimize this it is advisable to run a neutral conductor throughout the network, so that under only abnormal conditions will the earth be called upon to carry current. As ground lines have been demonstrated to be advantageous for lightning protection, and are quite generally in use on transmission systems, it is only necessary to substitute a wire capable of carrying the maximum neutral current in place of the ground wire, the added expense being slight.

The question of grounding is one which has been under discussion for years past, but to-day is still being argued.

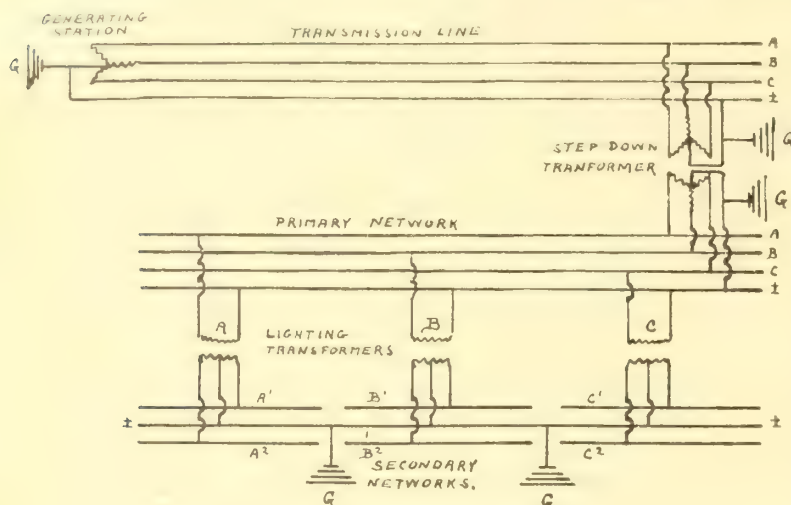


Fig. 3.—Separate grounded neutrals.

The advisability of grounding below 250 volts is seldom questioned, the problem being simply that of getting a permanent ground. Here, however, the problem is supposed to be one of life hazard only, and the increased efficiency and reliability of a system when its position in relation to earth potential is definitely established appears to have been entirely overlooked. Any electric circuit, unless effectually grounded at some established potential point, is like a lost soul floating around in space. Its potential to earth may vary by thousands of volts, irrespective of its normal working voltage.

It has been a fixed law of the universe from the days of the creation that all things must start from the earth's surface, either up or down. The writer is firmly convinced that electric circuits are no exception to this law, and, unless we firmly anchor them to the earth, sooner or later something will happen with disastrous results. This subject is one which alone could be made to cover a paper as large as the Good Book we all try to follow, and, as the proof of the pudding is in the eating, those who have not tried grounding can get all the proof needed by adopting this method. By "grounding" we mean, however, **solid grounding**, and not driven pipes, plates buried in coke, so-called grounding cones, limiting resistance and what not. A pipe forming a portion of a buried piping system is the only successful ground the writer has so far discovered. Our results following grounded operation lead us to believe that every electric circuit should be grounded, irrespective of the voltage at which it operates. In transmission circuits the objection to solid grounding has always been that a ground on any of the three-phase wires renders the system inoperative. This is undoubtedly true, but if the system has normally operated ungrounded, will not some unexpected weak point break down when subjected to full poten-

tial to ground. In this case, and it will be true in many cases, the systems will fail to operate in any case. It is very nice from an operating standpoint to hang on to our load to the limit. But, as engineers, is it good policy to continue a system in operation after it has developed what is known to be an abnormal and dangerous fault?

With the three-phase four-wire system, having solidly grounded neutral, there is one advantage which particularly applies to suburban distribution where the lighting load forms a large proportion of the whole. This is the ability to operate two of the phases after the third has developed a fault which renders it inoperative. The load of the faulty phase can be transformed to one of the good ones and the lighting and single phase motor load carried until permanent repairs are made.

For suburban and semi-urban distribution it does not follow that because our generating system is three-phase the entire distribution must be the same. For lighting circuits the simplest and best secondary distribution is the single-phase three-wire system. In order to permit of inter-connection of these secondaries into a network covering a considerable area a single-phase primary is desirable. With this in mind it is now almost uniform practice to distribute lighting by single-phase sub-feeders, either balancing on different phases at the main bus or at selected points on a three-phase feeder line. For power distribution it used to be considered necessary to have multi-phase currents, but recent developments have overcome this for motors of small size, say up to 15 horse power. For these the modern single-phase motor fulfills all requirements and greatly simplifies the distribution and metering problem. Motors on suburban lines seldom exceed five horse power and up to this size they can usually be operated off the lighting network, unless frequent starting and stopping is necessary and their use extends regularly over into the lighting peak. In this case, and in motors of

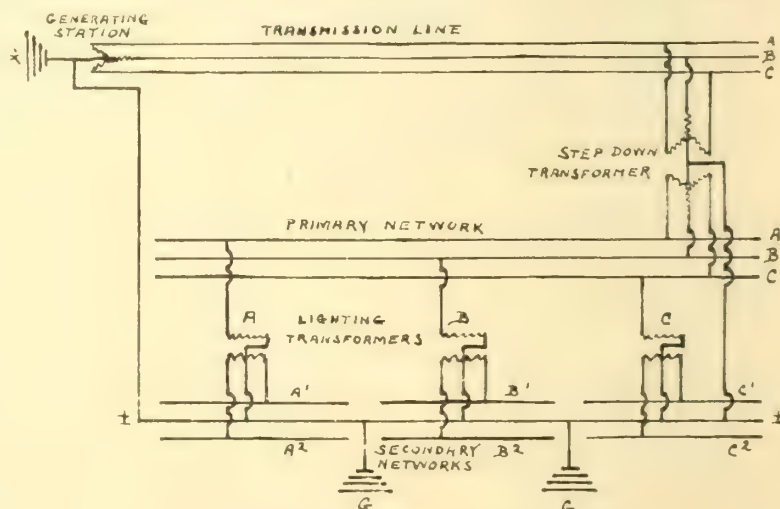


Fig. 4.—Common grounded neutral system.

larger size, individual transformers are desirable. Where these are necessary they should leave their neutral point connected to the lighting neutral, which, of course, is solidly grounded. If this point is overlooked we do not properly protect our power customers against high tension crosses or leakage.

As to the point where it pays to distribute three-phase from the sub-station or generating station in preference to single-phase, neglecting demands which may arise for large motors,—this is where the investment for copper, in position, for the three-phase (four-wire) feeder equals that for a single-phase line. As No. 4 wire is the smallest which

should be used for distribution and give the requisite margin of mechanical safety, it will be found that a No. 0 single-phase line is the largest that should be run. In fact, if No. 0 is required then preference should be given to the four No. 4 wires operating three-phase grounded star.

After having overreached the economical bounds of single-phase feeder distribution and having adopted three-phase, the question comes up as to at what limit the latter becomes uneconomical when operated at the utilization voltage, or the voltage at which the distribution transformers are operated. This limit has been increased three-fold by the adoption of the four-wire system, and it is now possible to transmit at the working voltage of 4000 a considerable amount of power over a considerable distance. A No. 2/0 circuit will deliver about 300 kw. a distance of ten miles without exceeding economical limits of line loss under ordinary suburban load conditions and average initial power costs. This is sufficient to feed a pretty well developed suburban town. A rough rule which has been used for some years is to allow 1,000 volts per mile. This is simply a rule of thumb, and is disproved right in the above case where this rule if applied would demand a transmission voltage of 10,000 in place of 4,000 as shown.

In the transmission of moderate amounts of power, the craze for high voltage lines can very easily get the better of one's common sense if one is not careful. The general rule in this regard is that the annual cost of energy lost in the line equals the annual cost for depreciation and interest on the line when maximum economy has been reached. In those cases where the selected voltage requires either step up or step down transformers, or both, the cost of these, together with their switching arrangements, must be included in the line investment. In many cases the cost of these, if put into additional copper, would carry the same amount of power with equal economy and cut out just that many links in the chain of trouble.

In designing any line the prospective future growth of the territory must be considered, and if this is promising and will eventually overreach the economical limits for 4,000 volts, then the line should be designed for high tension operation. In doing this it is as well to go the limit, which for this class of work is about 25,000 volts. The extra cost for wider spacing and larger insulators is so small that the extra investment is certainly warranted if future prospects look anywhere good. Such a line can be operated at 4,000 volts until such time as it becomes loaded. Step up or down transformers can then be installed and the change over made. There is no good reason for operating higher than reasonable requirements demand, and, consequently, the transformers should be purchased with double primary coils and operated at half voltage until the full pressure is required.

For distribution over a large area from a central generating station the writer particularly favors a method which is only made possible with the adoption of a solid grounded neutral three-phase four-wire system. This is the use of auto-transformers in preference to the regular double coil type. It will be shown later on how these work out for general distribution, and their use in transmission will now be explained. With the grounded neutral system and using step-down transmission, we would have in the complete system, under ordinary practice, no less than three neutrals; the secondary, the primary, and the transmission, Fig. 3. Each one of these being solidly grounded is to all intent and purpose one wire as far as potential is concerned. The natural thing to do is to combine them mechanically as well as electrically, Fig. 4. The neutral current distribution is somewhat complex and while capacity must be provided to

carry the greatest unbalanced load, in practice the currents are very small. In using a common neutral for all systems a single wire of the same cross section as the larger of the three separate neutrals will fulfill all requirements. The current distribution in such a common neutral is somewhat peculiar in that the drop on either circuit appears to be only that due to its own current and not that of the combined currents flowing. The heating effect may be that due to the combined currents or may be much less, as, under certain conditions, the neutral current from one system will flow in the opposite direction to that in the other and consequently tend to neutralize one another. This is one of the great economies made possible by a solidly grounded neutral.

As regards the auto-transformers, as used for distribution. Take a single coil transformer having its winding split up into four equal sections, each having a voltage of 2,300, Fig. 5. As a regular transformer assume this to have a capacity of 100. Connecting these coils two in parallel and the two sets in series we get an auto-transformer of 1:1 ratio, Fig. 6. One end of the coil goes to neutral, the middle to the distribution phase wire, and the other end to the transmission phase wire. Here we transmit at approximately 8,000 volts on the delta and step down to 4,000 volts for distribution, the star voltages being respec-



Fig. 5.—Development of winding, four coil auto-transformer.

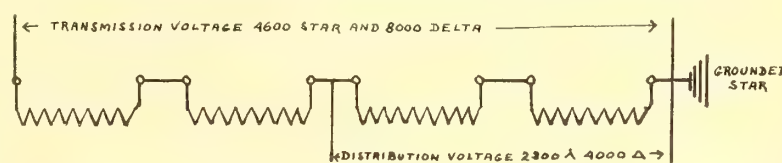


Fig. 6.—Auto-transformer connection, one-to-one ratio.

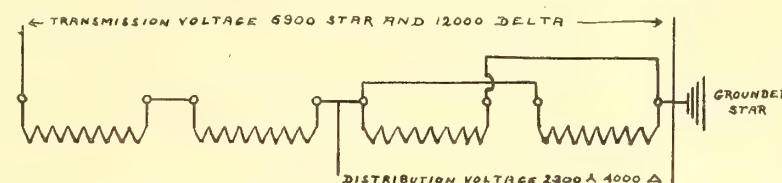


Fig. 7.—Auto-transformer connection, two to one ratio.

tively 4,600 and 2,300. The capacity of this auto-transformer would then be twice as much, or 200, and the investment for transformers but one-half that for the straight transformer connection as now used generally.

By connecting two of the sections in a series and these in turn in series with the other two coils in parallel we get a ratio of 2:1 and transmit at approximately 12,000 volts delta with a capacity of $1\frac{1}{2}$ times as much, or 150, Fig. 7, the transformer investment being but two-thirds that of the old method. A transformer of this kind would be insulated for 7,000 volts between coils and core and proportionately between coils; but at no time would more than a small portion of the winding be operated under this pressure, which would drop uniformly, throughout the winding, from maximum to zero.

This same principle can be carried out up to the highest limits of transmission voltages, but, of course, the economy in transformer investment becomes less as the ratio between distribution voltage and transmission voltage become greater. In very high voltages a further saving in transformer costs may be effected in that the maximum insulation need be only that for the star voltage and the insulation can then be

shaded down from this to a very small amount at the earthed star connection, only one high tension bushing being required, as it will never be necessary to reverse the windings to get the star voltage distribution to come right.

Another point of economy in the grounded neutral is that where a portion of all of the circuit is carried through lead covered cables. With a neutral not solidly grounded a four-core cable is necessary. With the solid ground it is not even necessary to pull in a bare conductor in the ducts as we already have a lead sheath capable of carrying, in a 3-core, 250,000 c.m. cable, about 100 amperes without heating enough to interfere with the capacity of the cable. By bonding all sheaths together a combined capacity far in excess of any normal requirement is obtained.

In operating the grounded common return system the first requirement after erecting the pole line is, of course, the running of this common return wire. For all ordinary cases of local distribution a wire of the equivalent of No. 4 copper is ample in size. From an operating standpoint it should be insulated with regular weatherproof insulation and supported on glass insulators if wooden poles are used and high tension wires are on same poles. This is not to insulate the return wire, which electrically can just as well be bare, but to prevent linemen working on the poles and handling high potentials coming in contact with the grounded conductor. An insulated wire is also of some benefit if a high potential wire falls over it, that is provided the other wire is also insulated and potential to ground does not greatly exceed 2,300 volts. In other words, for potentials up to 4,000 volts delta use insulation on all lines, and above this point omit insulation on the high potential and do not depend on it as a protection against crosses between the high potentials and the adjacent low potential circuits. Insulation which is not a protection is a death trap, and its omission is both a safeguard and an economy. This common return main must, as already stated, be permanently and effectually grounded. This condition can only be obtained by attaching to an underground piping system at numerous points. Fortunately, but few towns of even small size are to-day without their local water supply systems, and even the farmers quite generally have their own piping systems leading from a well to the various buildings. This makes it comparatively easy to get good ground connections.

In introducing services, good practice demands some form of sealed service box in order to prevent theft of current and also to prevent the consumer inserting service fuses dangerously large for his installation. This makes it imperative to enter the building through conduit, and the natural place to enter in this manner is the basement or ground floor. The fire underwriters require these conduits to be grounded to a piping system, and, by so doing, have made it very easy for us to get our common neutral grounded at every conduit service at a cost of but a few cents each. The process consists simply of placing a jumper between the conduit ground wire and the service wire which connects to our common return on the pole. This may be done at the service cutout and requires but a few inches of wire and a few moments of time. The various distribution neutrals should be cross connected as often as possible in order to form a series of neutral rings throughout the system. This makes it impossible to open the neutral or leave it unprotected by grounds, and, incidentally, permits of economic utilization of a cross section greatly in excess of that required on any one street.

Transformers connected to this common return system are of the usual standard type, stepping down from 2,200 to 110/220 volts. The primary supply requires, however, but a single wire, which can advantageously be attached to an insulator on steel pin placed directly in top of pole. This

type of pole construction, using a three-wire secondary main supported on steel vertical bracket, makes an unusually neat, as well as economical, design. In making extensions the three-pin secondary bracket is installed throughout the run and the common neutral placed on the center pin. The outer wires of secondary are then extended both ways from the transformer as required, and, when they meet, are interconnected. This makes possible a secondary distribution interconnected throughout even in new districts, the rule to apply being to extend the secondaries beyond the primaries in preference to installing additional transformers up to the point where the annual charges for outer wires of secondary system would equal the fixed charges of an individual transformer, giving careful consideration to the point

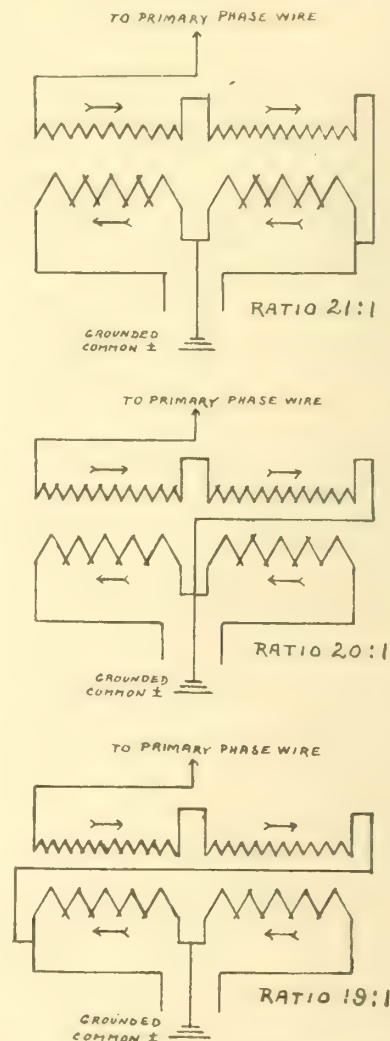


Fig. 8.—Variable ratios from standard lighting transformers.

that copper wire has a well fixed scrap value on which to base depreciation, whereas a transformer may last two years and may last twenty.

In connecting the transformer for standard ratio of 10 and 20 to 1 but one primary lead is used, being protected by a single pole fuse block. The other end of primary coil is connected inside the case to the neutral secondary lead. This connection may, of course, be made outside, but it is neater and better if made inside. This same transformer may be connected to either boost or crush 5 per cent. by simply tapping the other end of primary to one or the other outer leads of the secondary instead of the neutral. This gives, when connected to boost, an increased capacity of 5 per cent. The ratios thus possible to obtain without primary tapings are 19: 1, 20: 1, and 21: 1, Fig. 8. For transformers regularly supplied with 5 and 10 per cent. taps addi-

tional ratios of 17:1 and 18:1 may be obtained, Fig. 9. This makes an ideal system for suburban distribution, as the transformers in various towns may be so connected that their ratios bear an approximate relation to their distance from the main generating station and fair peak load regulation should be possible without individual feeder regulators, bus regulation being used entirely. For first class distribution, however, the automatic induction regulator for each feeder is

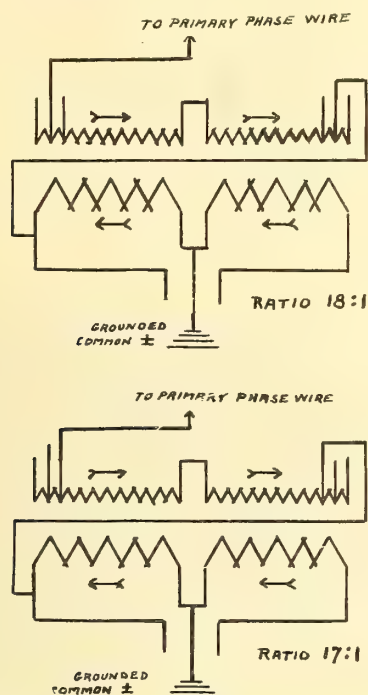


Fig. 9.—Special ratios with transformer having 5% and 10% taps.

the only solution. These are fairly expensive, but their cost is well warranted by the results obtained, particularly in the case of a feeder supplying several small towns or separate load centres. For a single feeder this condition requires very heavy wire between the load centres in order that the difference in primary pressure may be very low. This frequently makes it necessary, where local regulation is not used, to run separate feeders to each centre. With an automatic regulator installed at each load centre absolutely uniform pressure may be obtained in every town, even if several are supplied from same feeder. The local substation need be but a small building and requires very little attention, a visit once per week to clean and inspect the regulator contacts being all that is required. This plan of supplying each load centre from a small substation is of further advantage in that automatic protective devices may be conveniently installed here to cut off this particular section in case of trouble. The regulator is supplied by its own potential and current transformers, and a single-phase 5-ampere integrating secondary wattmeter may be installed on the same transformers, thereby measuring at very small expense all the current delivered to this particular section. This is of particular benefit to both the distribution and commercial departments, as it enables them to check up the line losses and also the revenue obtained from any one load centre or district.

The outer secondary leads of all transformers should be protected with low tension fuses, the neutrals, of course, being connected solid. In networks a fuse may also be inserted in the mains half way between transformers. In fact, this is necessary unless the primary feeding the network can be disconnected in case of trouble. Unless this is done the transformers banked can not be re-fused if they blow out under load. In large networks the better practice is to

connect solid and depend on the heavy current available to burn off faults, etc.

Just a word of caution, however, in regard to these secondary fuses. They are exposed to the weather and an ordinary lead and copper tip fuse will disintegrate. Use cast brass or copper contact posts and wing nuts and copper fuses. A plain copper wire supported on about four-inch centres makes an ideal fuse for exposure to the weather. No. 18 B. & S. gauge will carry about 100 amperes, No. 16, 150 amperes, and No. 14, about 200. An ideal distribution is shown by Fig. 10.

In high class suburban districts occasional demands arise for underground distribution. This can be cheaply and reliably handled by simply laying the cables solid in the earth, covering them if desired with a treated plank to prevent mechanical damage. The common neutral may be a bare copper wire or plain weatherproof insulation. This type of construction for secondary distribution does not greatly exceed the cost of a first class overhead line when upkeep

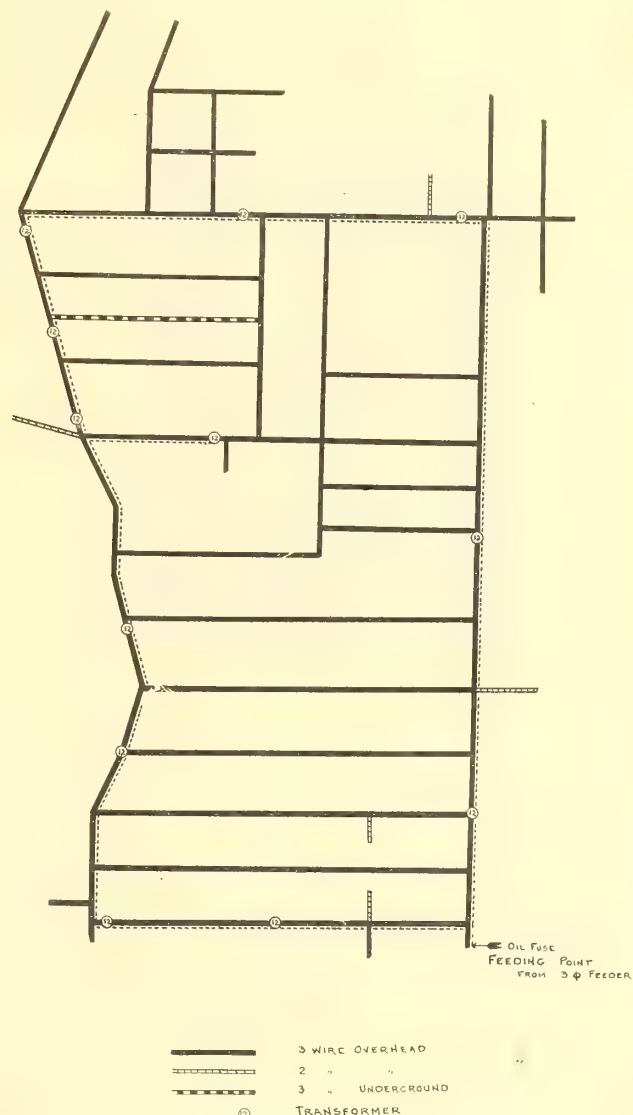


Fig. 10.—Typical secondary network.

and replacement costs are considered, and, being laid usually under unpaved streets or grass plots, can be opened up for repairs or extensions at minimum cost. Service taps are taken off through a small cast metal box enclosing the joint and afterwards filled with compound. The actual tap is usually made through a single strand of copper wire which will fuse under short circuit conditions and disconnect the defective service. If single branches are made the box

should be of non-magnetic metal, to avoid inductive effects. If made of cast iron the box must enclose all wires of the main, and these must enter through a non-magnetic bushing. Lead makes the best metal for this purpose. On extensive underground networks junction points should be sectionalized in a pillar box placed near the curb at intersections.

It must be self-evident that a system on the foregoing lines can be installed with less upkeep cost than former methods, and, having fewer parts to cause trouble, must perforce be more reliable. As to just what savings are possible, that can only be determined by figuring actual cases. This saving is, however, very considerable, as has been proven by actual operation of such a system.

Personals

Mr. J. E. Hutcheson, general superintendent of the Ottawa Electric Railway Company, has been appointed general manager of the Montreal Tramways Company. Mr. Hutcheson was born in Brockville, Ont., in 1858 and entered the service of the Grand Trunk Railway Company in 1876 as telegraph operator. In 1884 he was appointed train des-



Mr. J. E. Hutcheson.

patcher in Ottawa for the Canadian Pacific Railway Company and later became train master, which position he retained up to 1891. In this year, when the Ottawa street railway commenced operations, he was appointed general superintendent, and this position he has held up to the present date. Under Mr. Hutcheson's management the Ottawa Electric Railway Company has for years enjoyed the distinction of being the best dividend earner in the Dominion, while at the same time the relations between the company, the employees and the public have been unusually harmonious. With such a record the Montreal Tramways Company are well advised in their choice of Mr. Duncan McDonald's successor.

Mr. Bion J. Arnold, of Chicago, with Mr. John W. Moyes, of Toronto, has been appointed to make a report on the railway problem in Toronto.

Mr. J. W. Fraser, formerly assistant chief engineer of the Southern Power Company's transmission system, with headquarters at Charlotte, N.C., and more recently of Manchester, England, has now for address, c/o Hydro-electric Power & Metallurgical Company, Hobart, Tasmania.

Mr. H. G. Burd, who for some time has been connected with the Standard Underground Cable Company, as sales engineer in the New York office, has been appointed assist-

ant to the sales manager of the Standard Underground Cable Company of Canada, Limited, with headquarters at Hamilton, Ont.

Mr. William H. Marsh, who for the past ten years has been connected with the Standard Underground Cable Company, of Pittsburgh, Pa., in the capacity of Superintendent of Construction, has been appointed Secretary and Assistant Treasurer and Sales Manager of the Standard Underground Cable Company of Canada, Limited, with headquarters at Hamilton, Ont.

Obituary

Electrical Canada suffers a distinct loss in the recent death of Mr. H. P. Dwight, president of the G. N. W. Telegraph Company, and claimed to be the oldest telegraph operator in America. Mr. Dwight was born in Jefferson County, N.Y., in 1828, but came to Canada in 1847, securing employment first with the Montreal Telegraph Company. Later he became western superintendent and in 1881, when the Montreal and Dominion Telegraph Companies were merged into the present G. N. W., Mr. Dwight was appointed general manager and later, in 1892, became president. In 1903 he relinquished the position of general manager, but retained the position of president to the last. Mr. Dwight was vice-president of the Canadian General Electric Company and vice-president of the London Electric Company. Mrs. Dwight survived her husband only ten days.

Mr. Cecil B. Smith, senior member of the firm of Smith, Kerry & Chace, consulting and operating engineers, Confederation Life Bldg., Toronto, died quite suddenly at his home in Toronto from cancer. Strangely enough, the exact cause of Mr. Smith's illness was not suspected until within a very few weeks of his death, when he was on the way west in connection with business interests. Mr. Smith is best known in Canada through his connection with the Electric Power Company, a comprehensive system which operates in central Ontario, rivalling in magnitude the operations of the Hydro-electric Power Commission of Ontario. Mr. Smith graduated from McGill University in 1884, when at the age of nineteen, he carried off the Governor-General's Medal. Following graduation, he was successively resident engineer with the N. P. & T. Railway, Ontario; of the St. Catharines & N. C. Railway, Ontario; and of the C. P. R. at London. He was local engineer T. H. & B., Hamilton; divisional engineer C. C. & C. Railway, Tennessee; chief assistant engineer Roanoke & Southern Railway, N.C.; assistant engineer, B. & O. Railway, Morganstown; assistant professor civil engineering McGill University; assistant engineer city of Toronto; engineer of construction, Canadian Niagara Power Company; chairman of and consulting engineer to the T. & N. O. Railway Commission. In 1905 Mr. Smith was also appointed chief engineer for the Hydro-electric Power Commission and formulated the engineering policy of this body for the two following years.

Of the various operating plants which Mr. Smith and his firm have constructed may be mentioned the plant of the British Canadian Power Company on the Matabitchouan River, the plant of the Calgary Power Company on the Bow River, the hydro-electric plants at Nelson and Revelstoke, the municipal plant for the city of Winnipeg and the hydro-electric plant and electric railway system for the Mount Hood Railway and Power Company.

Mr. Smith was the subject of a short biographical sketch in the "Makers of Electrical Canada" series of the Electrical News in October, 1911.

ELECTRIC RAILWAYS

New Peterboro Radial Equipment

The Peterboro Radial Railway Company is adding to its equipment three new coaches of the design shown herewith. These cars are of Ottawa Car Company manufacture, a brief description of which follows.

The car bodies are of a semi-convertible type with omnibus sides and drop sash windows. They are also arranged with p.a.y.e. platform at rear end. The general dimensions are: length of body, over bulkheads, 18 ft. 6 in.; length of front vestibule, 4 ft. 6 in.; length of rear vestibule, 5 ft. 6 in.; length over bunters, 29 ft. 6 in.; width over belt-rails, 8 ft. 2 in.; seating capacity, 22 persons.



Type of New Peterboro Equipment

The car bodies are equipped with rattan covered seats, pantasote window curtains, electric lighting and bell fixtures, electric heaters, Ackley hand brakes, Ottawa Car Company's track sanders, and all other minor fittings and appliances generally found on cars of this type. Trucks are Brill No. 21-E with 8-ft. wheel base. Motor equipments are G. E. No. 80, two motors per car.

Motor Car Equipment Layout

The question of disposal of apparatus under electric railway cars is often a perplexing one. The space is limited between trucks, and often the underframe members, such as sills and needle beams, interfere with the proper distribution and mounting of control air brake auxiliary equipment under a car. For a successful arrangement, one main and important feature, accessibility of apparatus for inspection and repair, must not be overlooked.

In the case of the cars for the New York, Westchester

& Boston Railroad, which were designed by L. B. Stillwell, consulting engineer, New York City, built by the Pressed Steel Car Company, Pittsburgh, Pa., and equipped with Westinghouse motors and control, the inherent construction is such as to allow a simple and logical arrangement of equipment, effecting economy in wiring and conduit, and last, but not least, accessibility for inspection.

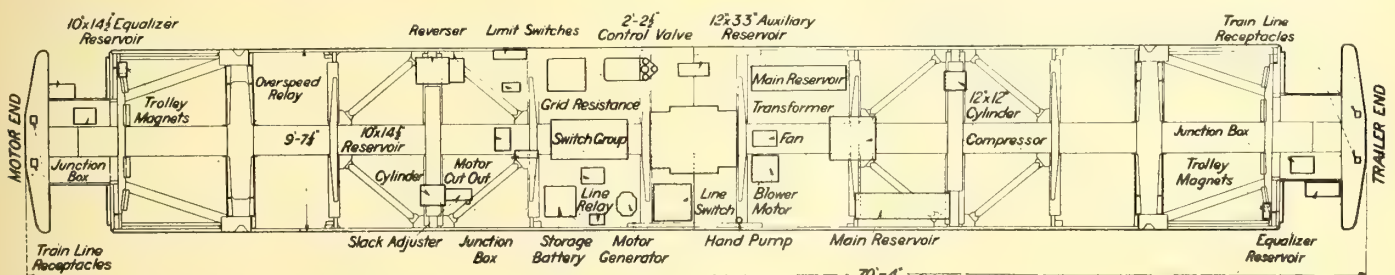
The motor and control equipment consists of two Westinghouse 170 h.p. single phase, 25 cycle railway motors and automatic unit switch control. From the control equipment on these cars, one is able to obtain a good idea of the extreme simplicity of single phase equipment.

Reference to the equipment layout drawing shown will show that when one of these cars is placed over a pit for inspection, after the two motors have been looked over, the inspector can start along one side of the pit, as all covers or compartments open to the outside. After finishing with the compressor, he can return by the opposite side. The three heaviest pieces of apparatus, namely, switch group, transformer and compressor, are mounted under the center of the car. The switch group and compressor are readily accessible for inspection and the transformer can be easily reached when necessary. Attention is called to the location of the transformer and automatic high tension oil line switch. This line switch is so located that the high tension trolley cable comes direct to it by the shortest possible route. Since the transformer is very near the line switch, there is no long run of high tension cable mixed with the other car wiring. In view of the fact that there is only one motor truck on these cars, it was decided best to mount the reverser as near the motor truck as would be consistent and at the same time accessible, as shown by the above layout. With the above arrangement, a thorough and systematic inspection of these cars can be rapidly made.

Tomlinson Automatic Air-Connecting Car-Couplers

The coupler shown herewith is designed for use in city and light interurban service where it is desired to connect up the air line of the train by the same operation that couples the cars. Its use saves time and reduces danger in coupling or uncoupling cars as the car coupling and air connection are made or broken automatically and simultaneously without it being necessary for a man to go between the cars.

The automatic air connection is made through two rubber gaskets, A, Fig. 2, projecting slightly from the face and held in air-tight contact by coil springs, F. An important feature in connection with these gaskets is their position with respect to the rest of the coupler as it affects their wearing qualities and, therefore, the efficiency of the coupler. They are set in the flat face of the coupler and operate in



Ideal Layout of Car Equipment providing accessibility for inspection.

a direction parallel to its axis. Furthermore, the coupler hooks and the guide pins bring the gaskets into perfect alignment before they come in contact so that there is absolutely no possibility for a shearing or abrasive action on the rubber. To uncouple the cars, it is only necessary to pull the un-locking chain on one coupler and after the

machines have been placed recently by the Toronto Railway Company and the Montreal Tramways Company.

A New Trolley Frog

Repair work on overhead construction must be completed in a very short time to avoid tying up service when

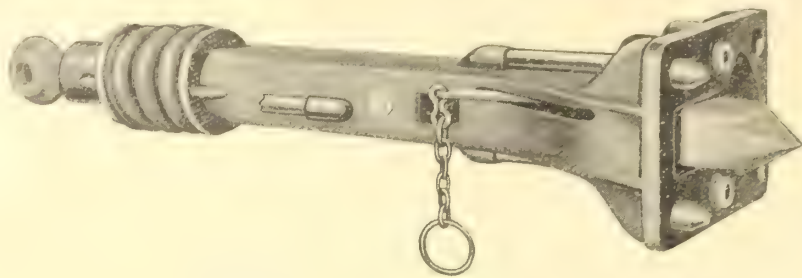


Fig. 1.—Tomlinson Automatic Coupler, Form 8—Patented.

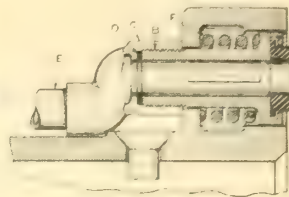
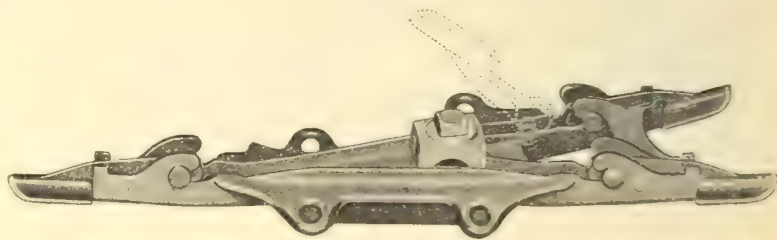


Fig. 2.—Details of Air Connection.

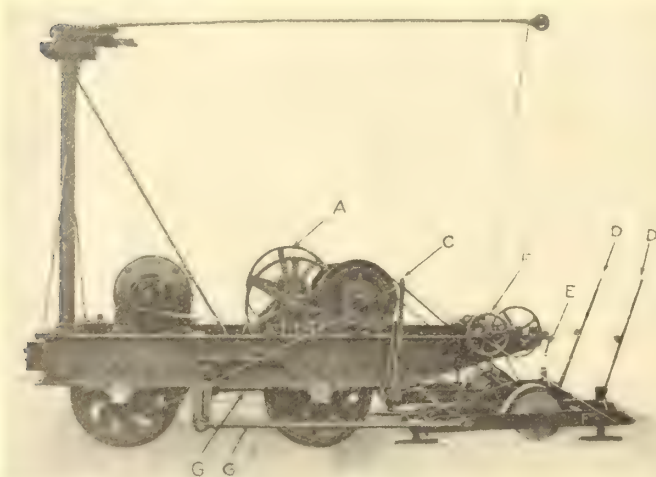
couplers have separated, the coupler hooks automatically resume the coupling position, ready for immediate recoupling. The arrangement gives a positive mechanical coupling between cars and a non-leakable automatic connection in the air line. The coupler is being manufactured by the Ohio Brass Company, Mansfield, O.

The Kerwin Rail Grinder

In a booklet issued by the Kerwin Machine Company, of Detroit, a machine known as the Kerwin Detroit Rail Grinder is described and illustrated. One of the illustrations is reproduced herewith. This is a machine that has been developed for removing corrugations from the rails of an electric road, and is claimed to make the surface of the rails smoother than when they came from the rolls. This grinder is a portable, self-propelled car while grinding, which operates emery grinders mounted on a sliding carriage. This carriage may be adjusted automatically or by hand to control the position of the emery wheel so it will take from the head of the rail cuts of required lengths and depths for the purpose of obtaining a perfectly smooth tractive surface. The grinder is entirely automatic in its action and requires the services of only one man to operate. The advantages claimed for the



Type D Trolley Frog—Patent Applied for.



The Kerwin Rail Grinder.

holding it securely whether the wire be new or badly worn. In installing, the wires are attached to the pan by the central clamp and a single machine bolt, after which the renewable tips are inserted under the hooks upside down with the ends pointing toward the centre of the pan, and are then forced over and outward until the lips enclose the wire ready to be peened around it—the final operation of the installation. In this position, the tips are interlocked with the end of the pan casting so that it is impossible for them to work out from under the hooks. When worn, the tips may be easily renewed without unfastening the wires from the pan casting. The arms are provided with long gradual inclines which give an easy approach and the sides of the pan are flared outwardly at the ends to draw in any size wheel. A deflector bar between the diverging arms prevents the harp from being wedged should the wheel jump. The Frog is made either all bronze or with sherardized malleable iron pan and bronze tips, and is furnished for all sizes of wire.

On account of the general and increasing interest in the smoke problem, the University of Pittsburgh, through their Department of Industrial Research, announce that a series of lectures on this subject will be given by different members of their staff.

The Rideau Electric Supplies Limited, has been incorporated with a capital of \$40,000, to carry on a general and contracting business. Head office Ottawa.

sliding shoe is that it spans the corrugations or other unevenness in the head of the rail, causing the emery wheel to grind off a perfectly smooth surface, whereas the wheel of other grinders drops into each corrugation causing the emery wheel to grind another corrugation. Orders for these

Two 70-ft. Gasoline McKean Motor Cars for the Victorian Railways, Australia

The McKean Motor Car Company, of Omaha, Nebraska, recently shipped two 70-foot, 200 horse-power gasoline motor cars to the Victorian Railways, Melbourne, Australia. This shipment required five flat cars for its transportation to Tacoma, where they were loaded on the Frank Waterhouse Line. The two boxes containing the car bodies measured 70 feet in length by 11 feet wide by 10 feet high, which are the largest boxes ever shipped in the history of rail or water transportation.

These cars are adapted to the special requirements of the Victorian Railways, the gauge of which is 5 feet 3 inches.

The engine is mounted on the front truck and is quite independent of the car body. The drive is direct from the engine, by means of a 5-in. Morse silent chain, the driving sprocket uniting the two halves of the crank shaft. The driving half of the friction clutch, together with the driven sprocket, are mounted directly on the main axle, the drive from the friction clutch to the axle being transmitted by means of a sliding clutch. Forty-two inch steel tired drivers are used, the wheels on the rear axle of the motor truck and both axles of the rear truck being 33-in. rolled steel.

The engine is water-jacketed, the jacket consisting of $\frac{1}{8}$ -in. copper sheet. The cooling water is circulated by a gear pump through the pilot radiators, two rear radiators



70-ft. all-steel McKean Gasoline Car built for the Victorian Railways, Australia

They are equipped with English standard coupling and buffing gear (front and rear). The centre side door entrance is especially designed for handling passengers on depot elevated platforms which prevail in Australia. They are built to accommodate thirty first-class passengers and forty-three second-class. Each compartment is divided into non-smoking and smoking compartments, by means of sliding doors. The second-class passengers are placed in the rear, and the first-class forward of the centre side entrance behind the ten-foot baggage room.

The construction of the cars is steel throughout, being built up of standard rolled sections, the centre still being an 8-in. I beam, and the two lower side sills 6-in. channels. The side sheets are of No. 12 Bessemer sheets and the roof sheets No. 16 Bessemer, riveted to channels, forming posts and carlins, which are continuous from side sill to side sill, thus giving the greatest possible strength with the least possible weight. The circular windows, which are wind, dust and water-proof, permit of this strong construction.

The cars are ventilated automatically, by the motion of the car, air being admitted through intakes which pass it over the car heating coils; the foul air is exhausted by suction ventilators in the roof.

Lighting is by the commercial acetylene system, the gas being carried under compression in a tank. The ignition system of the motor is both magneto and coil; the coil is supplied with duplicate sets of accumulators.

The cars are propelled by a 200 horse-power, air starting, reversible gasoline engine. The dimensions of the engine are: 4-cycle, 6-cylinder; diameter, 10 in.; stroke, 12 in.; horse-power, 200 at 350 r.p.m.; valves, nickel steel, 4 in. in diameter, mechanically operated; crank shaft, .30 carbon steel, 4-in. crank pins, 5-in. main bearing; carburetor, 3-in. McKean, equipped with cold-day starter; cam shaft, sliding, reversible, gear driven.

and car heating coils, the latter being cut out in hot weather.

The general dimensions of these cars are: gauge, 5 ft. 3 in.; length, 70 ft.; length of baggage compartment, 10 ft.; length of first-class compartment, 15 ft. 6 in.; length of second-class compartment, 21 ft. $\frac{1}{4}$ in.; width over all, 10 ft.; height over all, 11 ft. 9 $\frac{3}{16}$ in.; weight, 68,000 lbs. This Australian shipment increases the number of McKean cars in service to 122.

Extension of Direct-Current Railways by the Application of Higher Voltage

At the Saratoga convention of the New York State Association, Mr. William P. White, General Electric Company, outlined some different methods of obtaining and utilizing 1200-volt direct current. The conditions to be met arrange themselves into two general groups—one the changing over of present 600-volt or single-phase systems and the other the building of entirely new lines. The substance of Mr. White's remarks with reference to the former are given below.

To change over an existing single-phase road it is necessary to supply entirely new equipments for substations and cars and to change the transmission line, if single phase, to three phase or quarter phase. The overhead trolley, being insulated for the high-voltage alternating current, can be used without change for the 1200-volt direct current. The question then arises: If such changes are made, will the operating expense of the road be just as great as with the single-phase system? The best answer to this is the practical case of the Washington, Baltimore & Annapolis Electric Railway.

This road, connecting Washington, Baltimore and Annapolis, had a single-phase, 6600-volt system. After operat-

ing a year and a half as a single-phase road it was changed to a 1200-volt direct-current system. The change from single phase to 1200 volts was made in the following manner:

The cars used during the time that the single-phase system was in operation were 60 ft. long. On account of this extreme length and the excessive weight of the complicated a.c.-d.c. equipment the total weight per car was about 60 tons. This weight made the operation of cars over the city conduit system in Washington prohibitive.

When the change to 1200 volts was made it was possible to use practically 600-volt apparatus. This was mounted on a 50-ft. car having a seating capacity of fifty-four and a total weight, loaded and equipped, of 42 tons. Each car has four 600-volt motors insulated for 1200 volts, two motors being connected permanently in series. The control, with slight modification, is practically a standard 600-volt multiple-unit control with a dynamotor supplying 600-volt current for lights and for the operation of contactors when operating on 1200 volts.

In the substations two standard 600-volt, 25-cycle rotary converters, with additional insulation for 1200 volts, were connected in series to obtain 1200-volt current. Recent developments have made it possible to build a 25-cycle rotary converter with 1200 volts on one commutator, so that the present practice would be to use one rotary converter in place of two where only 1200 volt current is supplied from the substation. The direct-current, 1200-volt rotary converter panels were equipped with standard circuit breakers, switches, instruments and meters, located on the panel and insulated for the protection of the station operator. The circuit-breaker and main switch were placed side by side at the top of the 99-in. panel and separated by a slate barrier. Their operating handles are on the middle section of the panel approximately 30 in. above the floor. These handles are connected by means of insulating rods on the back of the board to the circuit-breaker and switch. The ammeter has a molded insulating cover. The watt-meter has a glass cover.

Since the change-over of the road in February, 1910, the carhouse expenses and power bill have been cut practically in half and the operation of the road has been satisfactory to the company and the public.

Changing a Low-Tension D.C. Road

If the road under consideration is a 600-volt, direct-current line, it is possible to use the existing apparatus to a large extent and to eliminate some of the substations. The Oregon Electric Railway gives an example of what can be done along this line.

This was a 600-volt road, the main line connecting Portland with Salem at the south, a distance of 51 miles. It also has two other divisions, 20 miles and 3 miles respectively, making a total of about 75 miles. The road is being extended south to Eugene, a distance of approximately 75 miles, and is contemplating a branch to McMinnville, a distance of approximately 25 miles. The entire system, with the exception of that portion in the cities, is being changed to 1200 volts, direct current. By this change the number of substations on the existing line will be reduced from five to three, while for the 75-mile extension only four new substations are required.

The 600-volt substations which are retained were made 1200-volt substations by placing in series two of the existing 600-volt rotary converters, the one on the high side being mounted on an insulating base of wood. The new 1200-volt substations will contain rotary converters delivering 1200-volt current from a single commutator. These machines are of the commutating-pole type and are capable of carrying momentarily three times load, or an overload twice as great as a rotary converter of the non-commutating-pole design.

This type of rotary converter is well adapted to the large fluctuating loads of interurban service where the load factor on the machine is small.

The car equipments are changed for 1200 volts by using two motors connected permanently in series, the motors on the ground side being the 600-volt motors already under the car and the motors on the high side being new 600-volt commutating-pole motors insulated for 1200 volts. The gearing of the motors is selected to give the correct motor speed for a given car speed.

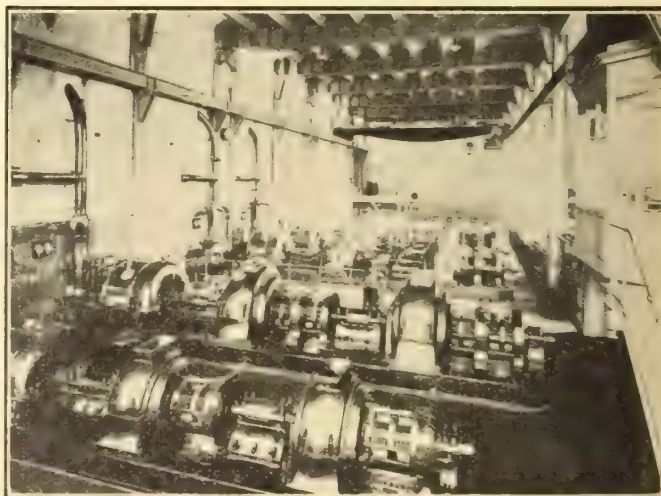
Most of the overhead trolley construction was of the catenary type with sufficient insulation to stand the added voltage so that practically no change was made in the overhead trolley line.

The Fort Dodge, Des Moines & Southern Railway is another 600-volt road which has been changed over to 1200 volts. This road has extended its line and has reduced the number of substations from six to five. One of the five is a substation for supplying 600 volts only, so that the number of substations in reality has been reduced from six to four, with 26 miles added to the total length of the road. This road, like the Ogden Electric Railway, has its 600-volt rotary converters connected in series to deliver 1200 volts, the rotary on the high side being mounted on insulating base. The substation on the new extension contains a rotary converter delivering 1200 volts from one commutator.

Mr. White sums up his conclusions in the following words: It has been shown by the foregoing practical illustrations that the 1200-volt system readily lends itself for adoption on extensions of direct-current railways, regardless of the source of power or type of apparatus used. The roads hereinbefore described cover examples of two 600-volt generators or rotary converters in series; straight 1200-volt generator or rotary converter; two 600-volt railway motors in series; straight 1200-volt motor; 1200-volt overhead trolley and 1200-volt third-rail. It is the simplicity, flexibility, reliability and low operating cost of this system that have resulted in its being a signal success wherever installed. The system should in no way be looked upon as being in the experimental stage, and any railway contemplating suburban or interurban extensions can adopt the 1200-volt system with every assurance of success.

A Fine Turbo-Generator Equipment

The cut shown is a view of Westminster S. W. Electric Supply Corporation's generating station. The plant consists of three Siemens 1000 kw. sets, 400-460 volts, 1850 r.p.m. In the foreground is shown one of a pair of 300 kw. steam balancer sets, 200-250 volts, 3000 r.p.m. generators coupled in tandem.



Industrial Progress and Trade Notes

Trade Publications

Canadian Westinghouse.—The Railway and Lighting Department of the Canadian Westinghouse Company, Limited, Hamilton, Ont., have issued descriptive circular 1194 dealing with type Q direct-current generators.

Motor Converters.—Pamphlet No. 20 B issued by the Bruce Peebles & Company, Limited, Edinburgh, is descriptive of Peebles Motor Converters. This pamphlet is being distributed by Roper, Clarke & Company, Limited, Canadian representatives, Montreal.

D. C. Dynamos and Motors.—Pamphlet No. 21 B, describing Peebles medium-size, self-contained continuous current dynamos and motors. In the beginning of the pamphlet are given specifications of the various types, while farther on are ratings and efficiencies of the different frame sizes at standard voltages for protected, semi-enclosed and totally-enclosed machines. The approximate weights and dimensions of all machines are given. Special mention might be made of the mining type motor illustrated here. Roper, Clarke & Company, Montreal, are Canadian representatives.

Veritys Limited.—London, England, have just issued List No. X 159 on Aston Electric Drills; List No. X 146 on Aston Electric Drills and Grinders; and Publication No. 652 on Aston Radiant Lanterns.

Sales Data Sheets.—The Adams-Bagnall Electric Company, Cleveland, have issued Sales Data Sheets G-1-22 and G-1-23 describing Abolites for condulets and for ordinary commercial work; also shade holder Abolites.

Sockets and Attachments.—The Harvey Hubbell, Inc., have issued bulletin No. 141, descriptive of Hubbell attachments for pull sockets, and bulletin No. 142 describing Hubbell's sockets with locking spring shade holder attached to shell conduit box receptacle with elongated cap, and candelabra receptacles for candle fixtures.

Electric Specialties.—Catalogue No. 7, issued by the G. & W. Electric Specialty Company of Chicago, contains general description of the G. & W. line of specialties, including pot-heads of every kind and of every desirable combination.

Electric Locomotives.—Circular 1516 published by the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, contains complete illustrated descriptions of Baldwin-Westinghouse electric locomotives.

Westinghouse Equipment.—Circular No. 1155, descriptive of series arc lighting systems with Westinghouse-Cooper Hewitt rectifiers; also pamphlets describing Westinghouse commutating pole, type Q M, d.c. motors and Westinghouse special compound-wound Underwriters' motors.

Private Branch Exchange Switchboards.—Bulletin No. N 1005-2, issued by the Northern Electric and Manufacturing Company, Limited, gives details of their private branch exchange switchboards. These switchboards are made in various capacities up to 1,200 lines, and are recommended for use where conditions are such that an inter-communicating telephone system, on account of its limited capacity, would not be large enough to efficiently care for the number of lines desired.

Canadian General Electric Company, Limited.—Condulet Talks, Series 2, No. 10, descriptive of Type R Condulets

for arc-light hanger boards; also pamphlet descriptive of Shelton Vibrators and pamphlet describing H. & H. Hart Molding Switches.

High Efficiency Transformers.—The Canadian Moloney Electric Company, manufacturers of high efficiency transformers, are mailing copies of their new Canadian catalogue. This is a well-illustrated publication, containing accurate descriptions of the various types of transformer built by this company. Much valuable information may be gleaned from its pages by the operating engineer, not the least of which is contained on page 4, which explains why Moloney type transformers should be used.

O. B. General Catalogue

The Ohio Brass Company, of Mansfield, Ohio, is distributing to the trade its new general catalogue, No. 12. The catalogue consists of 490 pages, is well bound in cloth and contains the entire listing of this company's line of overhead materials, rail bonds, third rail insulators, O-B Hi-Tension Insulators, car equipment specialties. There are also many pages devoted to data which will be of particular interest to engineers and construction men. The catalogue will be furnished free of charge to anyone connected with the engineering or operating departments of electric railways or transmission lines.

The Mazda Ad. Book

The Department of Publicity of the National Quality Lamp Division of the General Electric Company has compiled and is distributing a "Mazda Ad. Book," containing suggested models for newspaper advertising copy suitable for use by central stations, electrical dealers and contractors. The advertisements, which set forth the advantages of electric light and of "National Quality" mazda lamps, are forcefully written and pointedly illustrated. The "Mazda Ad. Book" has been strongly approved by the various concerns which have received copies of it, and successful results are being reported from its use.

Electric Service Supplies Supplement

The Electric Service Supplies Company has recently published a supplement to Volume 3, of their catalogue No. 4, pertaining to mine and industrial supplies. This supplement shows new and improved devices and revised listings pertaining to the material covered by the general catalogue. The supplement contains 76 pages, each page showing some separate device. Each device listed is illustrated by neat half-tone cuts and the page devoted to each device is given up entirely to descriptive matter pertaining to its construction and operation, together with the listing. The supplement is devoted chiefly to the listing of such specialties as the Automotoneer, a mechanical device for "controlling the controllers," Garton-Daniels lightning arresters, Keystone steel gear cases, section insulators, and improved mine telephones. Besides these specialties there are also listed numerous supplies and equipment for mine and industrial work, such as new trolley wire suspensions, expansion bolts, trolley wire ears, splicing sleeves, strain insulators, frogs, ground fittings for lightning arresters, all sorts of electrical bells and headlights, trolley wheels and commutators, lamp guards, signs and rail-drilling machines.

Space-Saving Switchboard Meters

The increasing size of modern power developments and the growing scarcity of available space, particularly in large cities, have emphasized the need of compactness in switchboard design. The desirability of having all the meters in plain view of one operator has long been appreciated, and

meters that can be placed within range of the operator's vision from a given point remains the same. If, however, the same scale can be had in a smaller meter, the condensation of space is a distinct advantage. This result is obtained with the herein described seven-inch meters.

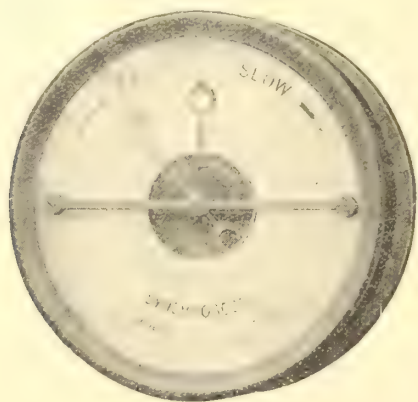
These meters are "superdamped," that is, the damping is



this requirement necessitates not only that the meters shall occupy a minimum of space, but at the same time they must be easily readable so that all can be read from a common point.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developed a complete line of seven-inch, round type switchboard meters. The size of these meters is such that three of them can be mounted in a horizontal row on a 24-inch panel, or two in a row on a 16-inch panel, whereas the ordinary 9½ inch meters and most of the better class horizontal meters require 30-inch panels for three meters in a row, or 20-inch panels for two in a row. While the resulting saving for one panel may seem small, the same saving carried out in a whole switchboard adds up to considerable proportions. A proportional saving in marble, busbars and general wiring results. A feature of a

such that the pointer does not overswing and return to the true reading, but comes up to the true reading and stops. Even a variation in load equivalent to full scale will not cause the pointer to overswing. This result is accomplished in the a.c. meters, where it is especially important, by magnetic damping;—an aluminium disc moving in the concentrated field of two permanent magnets. Damping of this nature is possible with these meters because they operate on the most improved form of the induction principle and are, therefore, unaffected by the fields of the permanent magnets. The torque of the meters is so high that the air dampers used in some delicate forms of meters would be entirely inadequate; and this high torque makes possible the use of correspondingly substantial control springs. The clearance of the magnetic dampers, as well as the air gaps of the movements, are large, and accidental friction from this source is thus rendered almost impossible. The whole construction of the meter is simple and rugged, so that the initial accuracy is maintained for long periods; and repairs, when necessary, can be made by the average central station attendant without sending the meter back to the factory.



board of the character of that noted is the uniformity of appearance of all the meters. This line of seven-inch meters includes alternating current ammeters, voltmeters, single-phase and polyphase wattmeters, frequency meters, power-factor meters, and synchroscopes, also direct current ammeters and voltmeters.

But the saving in space would mean little if the meters were not as easy to read as larger meters. In reality they are as easy to read as the Westinghouse 9½-inch meters, and this because of the length of their scales, the flat open faces which permit thorough illumination and visibility of the entire pointer, and the intense damping of the pointer. The true measure of a meter's "space efficiency" is not alone the area it occupies, but the length of scale per square inch of area occupied. A meter that occupies less area but requires the operator to be closer or to move about in order to take a satisfactory reading saves little, as the number of

The Keystone Traveller

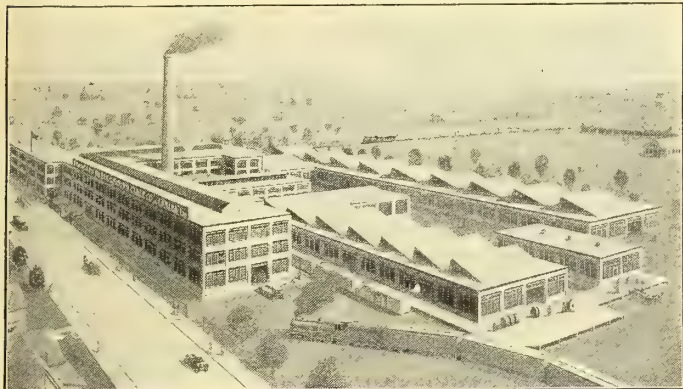
The July issue of the *Keystone Traveller*—the bi-monthly house organ published by the Electric Service Supplies Company—is devoted largely to a description of the new building now occupied by the Electric Service Supplies Company, explanation of the various departments, their work and method of carrying it out, and a detailed resume of the organization and growth of the company. The article concerning the organization of the company is a very interesting one, telling of the way in which the three companies, the Mayer & Englund Company, of Philadelphia, the Porter & Berg Company, of Chicago, and the Garton-Daniels Company, of Keokuk, Iowa, were consolidated. The Mayer & Englund Company was organized in 1895, the Porter & Berg Company in 1899, and the Garton-Daniels Company in 1892. The first two companies named conducted a general electrical supply business, acting as selling agents for many large manufacturing concerns; the Garton-Daniels company, conducted a manufacturing and sales business. The names of the Garton-Daniels lightning arrester and of the Automotoneer were inseparably linked with this company until its consolidation with the Electric Service Supplies Company.

The theme of the little introductory talk in this issue is "service," the title being "Service is Success." Some of the suggestions and statements made are extremely good ones.

New Industry for Canada

A substantial addition to the industrial life of Canada has just been made by the entrance into the field of the Standard Underground Cable Company of Canada, Limited. The large new plant of this company at Hamilton, Ont., has begun operating several of its various departments, and others, we understand, will be started as rapidly as possible.

The parent company began the manufacture of lead-covered cables and transmission of electricity about 1882, in Pittsburgh, Pa., and has been selling to the Canadian trade for many years. It originated and developed many of the types of cable and manufacturing processes in use to-day and was for years the only manufacturer of such materials in the



Hamilton Plant, Standard Underground Cable Co

United States. From the small plant in Pittsburgh the company has widened the scope of its business and increased its lines of products until now, in addition to the plant at Pittsburgh, enlarged from time to time, it has a large aggregate of plants at Perth Amboy, N.J., and Oakland, Cal., with a total floor space of over twelve acres. The products that come from these various plants include electric wires and cables of all kinds, for street railway, light and power, signal, telephone, telegraph, fire alarm, and any other service involving transmission of electric current by underground, aerial or submarine circuits. These products also include cable accessories such as terminals, and junction boxes, insulating materials, cable splicing tubes, hangers, etc.

It will be seen that while the company's name carries the implication that it is concerned chiefly with the manufacture of underground cable, yet as a matter of fact its products include almost every kind of conductor known to the electrical industry. Indeed, in range of products, and in the aggregate value of gross business, this company is said to exceed any exclusively electric wire and cable manufacturer on the American continent and probably in the world.

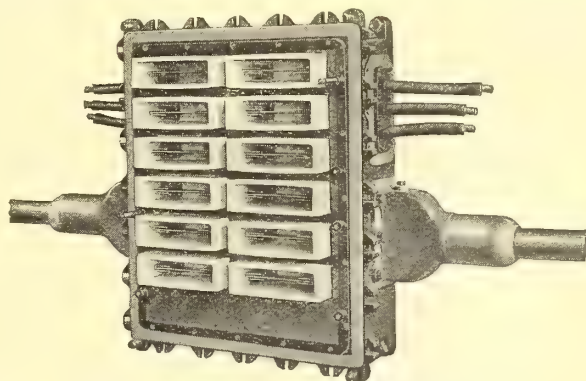
The new Canadian plant has been erected in Hamilton on a tract of land fronting 400 feet on Sherman avenue and extending 600 feet along the T. H. & B. Railroad, a location which has every advantage in the way of manufacturing and shipping. The buildings erected so far include: one three-storey brick and structural iron building, 64 x 335 feet; one one-storey saw tooth building, 60 x 224 feet; one one-storey saw tooth building, 60 x 250 feet; one one-storey building, 64 x 90 feet; one one-storey building, 30 x 70 feet; also an office building and other small buildings. The buildings are the very latest type of factory construction and represent with their equipment an investment of \$500,000. The plant is electrically operated throughout by power from the Dominion Power & Transmission Company's lines. The electric motors are 3-phase, 220 volt, induction type. The three testing laboratories are equipped with the most modern and up-to-date appliances for thoroughly testing all products before shipment. These appliances consist of regulating trans-

formers giving voltages as high as 60,000 volts, Wheatstone bridges, D'Arsonval galvanometers, Fisher testing sets, etc., for determining insulation resistances, capacity, conductivity, locating grounds, leaks or other faults in cables. The Hamilton Bridge Works Company, Limited, supplied the structural iron. The architects were Prack & Perrine, factory experts, of Pittsburgh and Hamilton.

The officers of the Standard Underground Cable Co. of Canada, Ltd., are: president, J. W. Marsh, president of the National Exchange Bank, one of the oldest financial institutions in Pittsburgh; vice-president and manufacturer, W. A. Conner; vice-president and general sales manager, P. H. W. Smith; secretary and sales manager, W. H. Marsh; treasurer, F. A. Rinehart; assistant sales manager, H. G. Burd.

A New Cable Junction Box for High Tension Transmission Circuits

A new type of cable junction box suitable for the inter-connection of high voltage feeders and mains is shown in the accompanying illustration. The flexible leads which project through the sides of the box are so arranged as to terminate within the large removable nipple. These nipples have a rounded or dome-shaped end made entirely of soft metal such as lead or lead-tin alloy. This dome-shaped portion is united with that part of the nipple which is of brass or other rigid material by an exceedingly strong and absolutely water-tight joint. The leads are connected to the outermost contact points of each row of disconnecting switches, the innermost point being connected to bus-bars, giving the desired inter-connection arrangements. The exposed live parts—that is, those shown in the cut—are isolated in cells of porcelain so that the disconnecting blades can be inserted or removed by means of insulated tongs with a maximum of safety. The porcelain cells are permanently fastened in a metal framework which in turn is fastened to the box, in such a manner that a chamber is formed between the framework of cells and the bottom and sides of the box. This



New Type High Tension Junction Box

chamber, after the carrying parts that enter it are put in place and insulated with tape when desired, and after the moisture has been removed by the heat and vacuum process, is filled with a hot insulating compound. Insulating stuffing boxes prevent the compound from oozing out along the flexible leads when the box again warms up under working load. The concealed current carrying parts of this box are, therefore, assembled and insulated before the box is sent out from the factory, where the work can be done with the greatest care by operators skilled in that particular work and under expert supervision.

To make the cable connections, all that is necessary is to unbolt the nipple from the box, cut off with a saw or jack knife the dome-shaped end of the soft metal portion of the nipple and, after threading it over the cable, joint the conductors to the insulated flexible lead. After this the nipple can be replaced, the joint wiped and the space within

the nipple filled with hot Ozite insulating compound. The connection is then complete. As the contact blades, when removed, leave the flexible leads dead, one or more of the cables may be connected after the box is in service and while it is alive. This box is adapted for inter-connecting two or more 1, 2, 3 or 4—conductor cables and may be used for alternating current or direct current circuits.

These boxes have been used in considerable quantities on circuits of 4,500 volts working pressure for a period of nearly two years with satisfactory results. In other installations they are operating at 5,000 volts. The same general design is suitable for still higher voltage. This box is manufactured by the Standard Underground Cable Company, of Pittsburgh, Pa.

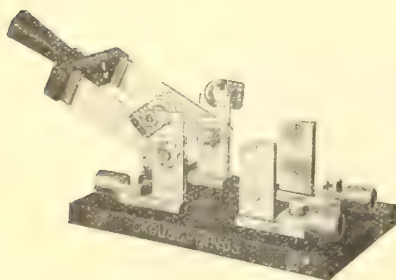
The Shurlok with Sealing Attachment



The accompanying illustration shows a device which has just been perfected by the Pass & Seymour Inc., of Solvay, N.Y., by which their Shurlok socket is made doubly secure. It is claimed sometimes, that these locks are tampered with and may be opened by ingenious meddlers, and the P. & S. Co. have overcome this difficulty by boring a small hole through the end of the fibre and the shell holding the lock. When the socket is in

place, a small wire is run through this hole and attached to the private seal of the company as shown in the illustration. Any attempt to tamper with the lock is indicated in this way as it is impossible to insert the key without destroying the private seal.

Safety-Lock Switches



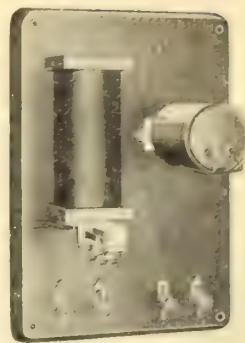
The Crouse-Hinds Company of Canada, Limited, has placed on the market a complete line of Safety-lock switches. Their use on electrically driven machinery makes impossible such accidents to repair men and machines as frequently result from the power being

turned on at wrong times. These switches are the regular Crouse-Hinds type B switches with the addition that one clip of each hinge standard of a two-pole switch and a clip of each outer hinge standard of a switch having three or four poles, are extra high and pierced with a $\frac{3}{8}$ -in. hole, centering $\frac{5}{16}$ -inch below top of clip, to receive the bow of a padlock. Provision is made for two locks—one for the machinist and one for the electrical repair man. The man about to work on the machine or motor opens the switch, snaps on the padlock, and, with the key in his pocket, proceeds with his labor. If machinist and electrician are to work at the same time, each, because of his separate lock, is fully protected, and the switch can not be closed until both locks are off.

The General Vehicle Company, of Long Island City, New York, have received an order from the Canadian Express Company, Toronto, for the delivery of four electric trucks, two of one ton capacity, two of two tons capacity. These will be operated by G. V. storage batteries and will be identical in appearance with the cut shown in the June issue of the Electrical News.

The Kellogg Howler

Telephone companies are often-times annoyed by subscribers leaving the receivers off the hook—time is lost and the service is more or less impaired. The Kellogg Switchboard & Supply Company have recently issued a four-page folder descriptive of their "Howler" equipment which is effectively used in remedying this evil. "Receiver off! Don't Send a Man," reads the front cover. "Have a Kellogg Howler to signal your subscribers who leave their receivers off hooks." In addition to this description on the cover is an illustration of a wire chief at his desk (just about to work the "howler"). Below this is shown the absent-minded subscriber reading his paper and—the receiver off the hook. On the second page is a halftone illustration of the simple apparatus necessary. Pages two and three are given over to description. Kellogg extra heavy moisture-proof cords are mentioned on the fourth page. The type matter, border rules and illustrations, are printed in brown ink and the booklet is a forceful sales argument.



The Invincible Renovator

The Invincible Renovator Manufacturing Company, Limited, of 81 Peter Street, Toronto, have placed on the market a vacuum machine that is claimed to combine, in a high degree, efficiency, durability, economy and ease of operation. The "Invincible," as it is called, is built on the closed fan principle, operating centrifugally, and so operates on the volume rather than the vacuum principle. It is built in five types suited for various forms of work, from the small portable, to the stationary plant large enough for apartment houses or large office buildings. This company has issued a descriptive booklet which, along with a minute description of their renovator also contains valuable hints on the most approved methods of installing stationary cleaners.



Northern Electric Company's Notes

Mr. M. S. Allen, telephone sales manager, is now in the West on an inspection trip of the company's branch houses.

Mr. W. Halpenny, of the manufacturing department, pole-vaulting champion of Canada, is a member of the Canadian Olympic team now in Stockholm.

Mr. A. D. Smith, railway sales department, is on a trip to the Pacific coast in connection with telephone train dispatching business.

Mr. W. M. Tiffany, fire alarm sales department, was in Toronto recently, attending the International Police Chiefs' Convention.

Mr. M. E. Deering, sales engineer at Winnipeg, was in Montreal recently looking after the new telephone switchboard for the city of Regina.

Among other switchboard orders recently received by this company may be mentioned a 19-panel board from the Montreal & Southern Counties Railway and a five-panel board from the Canadian Pacific Railway. The former is to control two sub-stations, one at St. Lambert and one at Chambly, while the latter is to be installed in the new C.P.R. office building in Toronto. Both of these orders were received under keen competition.

Northern Electric's New Catalogue

The Northern Electric & Manufacturing Company's general supply catalogue No. 2 is now ready for distribution, and copies will be sent to everyone regularly engaged in the electrical business whose name is at present on this company's mailing list. It is a large, well bound catalogue with over 850 pages of electrical supplies, telephone apparatus and fire alarm apparatus. An examination of the catalogue shows great care taken in compiling, particularly in the arrangement of the various sections, so as to make the location of any particular article quick and easy. The method of arrangement follows along the line of grouping the materials together in their various classes, thereby having the advantages of a separate bulletin catalogue, with the further advantage of the information all being under one cover, and with no possible chance of being incomplete. The material listed in the catalogue is all guaranteed up to Northern Electric standard of quality, and each line bears the guarantee of the manufacturer and of this company. Large and complete stocks of standard material listed in this catalogue are carried by the different branch houses at Montreal, Toronto, Winnipeg, Regina, Calgary, Edmonton and Vancouver, so that prompt shipment can be made to any part of Canada, and the delivery effected promptly.

Bell Telephone Building Notes

The Bell Telephone Company is erecting a building at No. 10 Main street east, Hamilton. The building will have frontage of eighty feet by one hundred and thirty-six feet deep; there are to be four storeys and basement, with provision for two additional storeys. Materials throughout will be of the best fire-resisting construction.

The first floor will be occupied by the company's public and local business offices; the second floor by the district offices and the long distance operating room; the third floor by the operators' quarters and the terminal room, and the fourth floor by the main operating room. The facade of the building will be of red sandstone and pressed brick, and metal wire glass windows will be used. Two elevators are being installed. This building will replace the present Hughson street building, which has become too small for the company's business.

Plans and specifications have been completed, and tenders will be called at once for an addition to the Bell Telephone Company's present building in London, Ont., which will make it rather more than double its present size. The addition will be of fire resisting material and in it a new switchboard equipment will be installed and the entire business now conducted in the present building will be moved into it. The present structure will then be rebuilt and made to conform to the style of the new building.

Plans for new buildings at Orillia, North Bay and Sudbury have also been drawn up.

The Keystone Wrench

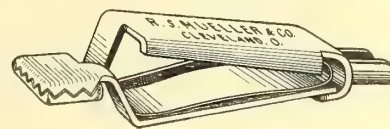
The accompanying illustration shows a new type of wrench being placed on the market by the Keystone Manufacturing Company, of Buffalo, N.Y. It is made in 6-in.,



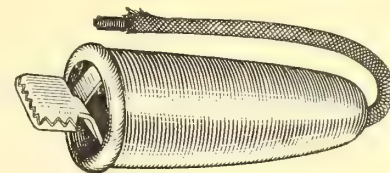
8-in., 10-in. and 12-in. sizes, of special grade steel, hardened all over, will operate square as well as hexagonal nuts and is fully guaranteed.

The Universal Test Clip

The accompanying illustration represents a test clip which is proving useful in a very great number of electrical operations, tests, etc. These are made with black and red nipples to distinguish the positive and negative poles of the



wire and are being found useful by telephone men, electricians, linemen, and troublemen generally. These clips have already been adopted by several of the largest manufacturers of electrical apparatus and insulated wires for use on all shop testing devices where a ready means of making a test connection is required. For such work as charging



cells, for example, they are also proving very valuable. The second figure shows the same clip covered by an insulating thimble. The Universal Test Clip is manufactured by the A. S. Mueller & Company, Cleveland, Ohio.

Canadian Tungsten Lamp Notes

The annual meeting of the Canadian Tungsten Lamp Company was held on Saturday, June 29th, every shareholder being represented. The president, in laying before them his annual report, stated that the financial statement showed a most satisfactory net profit, while the business done was considerably in advance of any previous year. Mr. Ginder also spoke of the severe loss the company had sustained in the death of their secretary, Mr. P. D. Crerar,



Mr. W. H. Ginder

K.C., and it was moved and seconded that a letter of condolence be sent to the late secretary's family. The board of directors was increased from five to eight, and an executive board of four members was also elected. The result of the election of officers was as follows:—president, Mr. W. H. Ginder; vice-president, Mr. F. W. Gates; secretary, Mr. G. H. Levy. Mr. Goodwyn was again appointed treasurer. Several improvements and additions were decided on, and although the business done last year showed

a net increase of 45 per cent. over the previous year, the company starts their new year with every prospect of beating this increase in the coming year.

One of the most attractive stalls in the exhibition at Winnipeg was that presided over by Mr. A. L. Woolf. An endless variety of "drawn-wire" kolloid-wolfram tungsten lamps was most artistically arranged, and a very large line of coal oil lighting specialties manufactured by his other agency, the Ontario Lantern & Lamp Company, added considerably to the attractiveness of this exhibit. Various samples of up-to-date electric fixtures in beautiful finishes made a tout-ensemble that was much admired.

Mr. W. F. Kelly, Ontario representative of the Canadian Tungsten Lamp Company, is making an extended yachting cruise through the Thousand Islands and lower St. Lawrence and expects to be absent two or three weeks.

Mr. F. W. Hollingsworth, western representative of the Canadian Tungsten Lamp Company, is away on his usual trip through to the coast.

Electric Truck vs. Horses

In any country the greater part of the hay and corn is fed to horses. Suppose the acreage necessary to raise the hay were to be cultivated and sowed to grain, and the bulk of the present corn and oat crop devoted to its legitimate purpose—the sustenance of the human race—the present economic difficulty of high prices and under-supply would be, to a great extent, remedied.

The advent of the electric truck has made this condition not so visionary as it would have seemed a decade ago. The percentage of shrinkage in horse-drawn vehicles in Chicago alone during the past year amounted to 15.7 per cent. for one-horse wagons, and 13.5 per cent. for two-horse wagons. Altogether 6,753 horse-drawn vehicles were discarded in Chicago between May 1, 1911, and May 1, 1912. Since an electric truck can handle tonnage equivalent to that of three two-horse wagons, the saving in time, money and congestion of traffic becomes very great.

The average life of an electric truck, based on actual records, is at least ten years, with a consequent depreciation charge of ten per cent. yearly. The average life of even the best Percheron draft horse is more like four years, and the depreciation consequently higher—twenty-five per cent.

From Campbellton, N.B., to Saskatoon

W. I. Snook, electrical contractor, has closed out his business in Campbellton, N.B., where he recently completed the electrical installations in connection with the new I.C.R. depot and the new post office, and has opened up in Saskatoon. Already he has been awarded, among other work, the contract for the electrical installations in connection with the new seven-storey Ross Building on Third avenue, and reports the outlook promising for future work.

A Unique Calendar

Everett, Edgcumbe & Company, Limited, London, have issued a unique universal calendar, the background of which represents an ampere-meter.

Obituary

Arthur J. Morgan, secretary of the National X-Ray Receptor Company, Chicago, died July 5th, of pneumonia, at his residence in Evanston. Born in Los Angeles, California, in 1873, Mr. Morgan came to Chicago in 1900. He was a mem-

ber of the Illuminating Engineering Society, Chicago Brass Manufacturers' Association, Chicago Association of Commerce, etc., etc. As a member of the Illuminating Engineering Society, and through his business connections, he had much to do with the recent advance developments in illuminating methods. The kindness of Mr. Morgan's disposition, his strength of character, and sterling honesty, made him a host of friends.

The City of St. Catharines has purchased twelve additional No. 5 Jandus Luxolabra from the R. E. T. Pringle Company.

Zoelly Steam Turbine Tests

We publish herewith some results recently obtained at official tests carried out with the Zoelly steam turbine, with capacities ranging from 1,250 kw. to 10,000 kw. The readings for steam consumption are quite remarkable, first, for the very low figures obtained; second, by the fact that the increased consumption at partial loads is kept within very narrow limits, especially when considering that the efficiency of the generators is decreased considerably when running at loads below normal.

Test No. 1.

Two 1,250 kw. Zoelly turbines, 3,000 r.p.m., delivered to the municipal power station at Drammen, Norway, in commercial operation since January, 1912; official test carried out, February 19 and 21, 1912.

Load	full	¾	½
Power in kw., inclusive of excitation but exclusive of power required for the condenser	1,275	981	656
Over-pressure at stop-valve of turbine in lbs. sq. in.	183.0	174.5	174.0
Temperature at stop-valve deg. F. ...	588	494	472
Vacuum at the exhaust branch in ins., referred to 30-in. mercury	29.06	29.22	29.42
Steam consumption in lbs. per kw.h.	12.60	13.80	14.80

Test No. 2.

One 5,000 kw. Zoelly turbine, 1,500 r.p.m., delivered and installed at the power house of Escout, near Antwerp; official tests carried out, January 22 and 23, 1912.

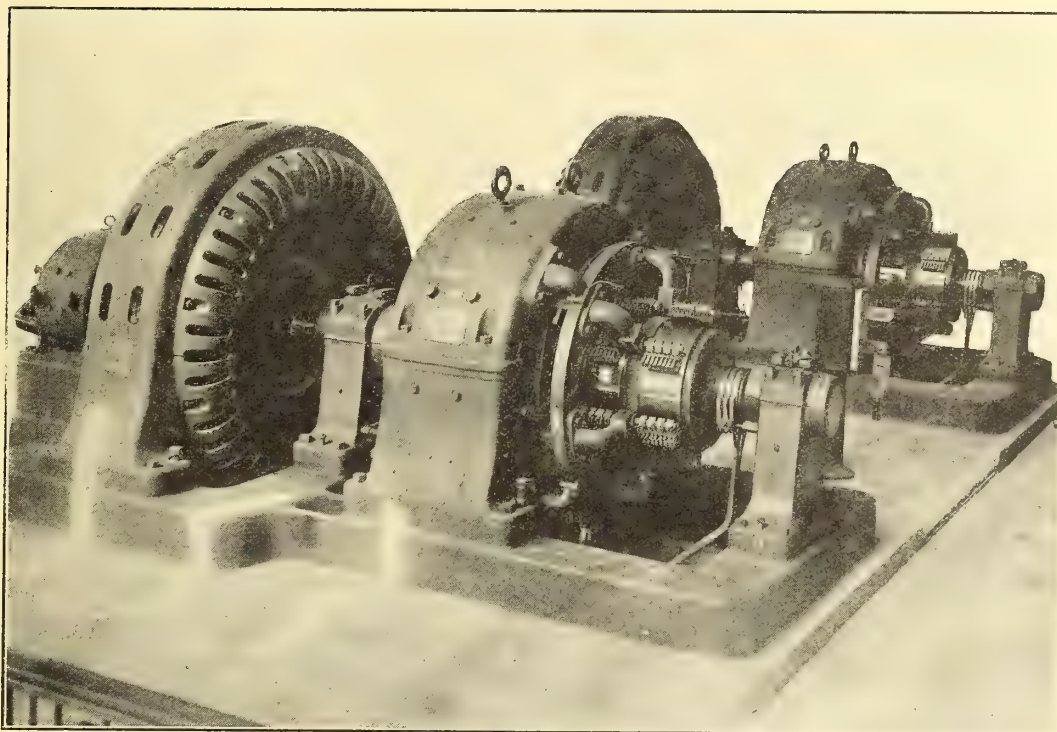
Load	full	¾	½	¼
Power in kw., inclusive of excitation, but exclusive of power required for the condenser	5418	4305	3160	1184
Over-pressure at stop-valve of turbine in lbs. sq. in.	167.0	168.0	173.5	169.5
Temperature at stop-valve deg. F. ...	588	556	559	520
Vacuum at the exhaust branch in inches (referred to 30-in. mercury)	28.90	29.10	29.26	29.55
Steam consumption in lbs. per kw.h.	11.92	12.32	12.65	14.70

Test No. 3.

One 10,000 kw. Zoelly turbine, 1,250 r.p.m., delivered for La Societe le Triphase a Asniere; officially tested February 12, 1912.

Load	full	1/3
Power in kw., inclusive of excitation but exclusive of power required for the condenser	10,006	3678
Over-pressure at stop-valve of turbine in lbs. sq. in.	154.0	162.5
Temperature at stop-valve deg. F. ...	566	567
Vacuum at the exhaust branch in inches (referring to 30-in. mercury)	28.72	29.19
Steam consumption in lbs. per kw.h. ...	12.00	14.50

SIEMENS



**Two Siemens 500 K. W. 720 r. p. m. 550/600 Volt Motor Generators, with Synchronous Motors
Supplied and Installed by us for the City of Winnipeg**

Attention is especially drawn to Siemens two piece commutator shown above. This type of construction has been standard with us for a number of years and used when the length of commutator exceeds about 11". The two sections are on the same bolts and connected by lugs so arranged as to form vanes and produce a current of air to pass through the two sections. The commutator is the same electrically but mechanically it is far stronger and in addition the following advantages are obtained:—**Thorough ventilation. Cool running assured. Short commutator bars used. Distortion due to temperature or mechanical stresses avoided. Surface always in good condition. Brush Spindles supported from middle of short rigid support.**

We have also delivered or have on order the following motor generators for other customers, viz:

One 800 K. W.—Dominion Coal Company.

Two 500 K. W. Sets for City of Port Arthur one of which is a repeat order.

One 400 K. W.—City of Lethbridge.

One 220 K. W.—Dominion Coal Company.

One 200 K. W. City of Lethbridge.

One 100 K. W.—Northern Ontario Light and Power.

Two 70 K. W. Winnipeg Technical Schools.

One 70 K. W.—Larimer Company, Winnipeg.

One 45 K. W. Winnipeg Free Press

Siemens Brothers Dynamo Works Limited

London, England

Paris

Berlin

St. Petersburg

Vienna

New York

Head Office for Canada

10 Adelaide Street East, TORONTO

Branch Office: 707 McArthur Building, WINNIPEG

Current News and Notes

Brantford, Ont.

A by-law to purchase \$125,000 debentures of the Lake Erie & Northern Electric Railway passed by a large majority.

Brockville, Ont.

The Light and Power department has obtained the town council to enter into a contract with the Ontario Hydro-electric Commission, for a supply of power to Brockville. Several months ago a by-law to this effect was passed by a large majority.

Barrie, Ont.

The Hydro-electric Commission of Ontario has decided to spend some \$200,000 in supplying electric power to Collingwood, Barrie, Coldwater, Elmvale and Stayner. The transmission line will be approximately sixty-five miles long. Power will be obtained from the Simcoe Railway & Power Company's plant at Severn River. Transmission will be at 25,000 volts and substations for stepping down to workable voltages will probably be installed at each of the points named.

Calgary, Alta.

As a result of dissatisfaction with the government telephone system of this city there is some talk of the installation of a municipal telephone plant.

Fort William, Ont.

A by-law authorizing the expenditure of \$200,000 on street railway improvements and extensions was overwhelmingly carried.

Fredericton, N.B.

Farmers in the neighborhood of Maugerville and Sheffield in Sunbury county have had their telephone rates raised. The rate will be regulated in future by the distance of the subscriber from this city. At eleven miles from the city, or less, the cost is \$18.00 with \$2.00 per mile added for each additional mile.

Galt, Ont.

By an overwhelming vote the ratepayers passed the by-law to purchase \$25,000 debentures of the Lake Erie & Northern Electric Railway.

By-law passed for completion of Hydro-electric lighting system and extensions.

Gananoque, Ont.

Following an arrangement made between the Gananoque Board of Trade, the Town Council and the Gananoque Water Power Company, under which each agrees to assume one third of the estimated cost, consulting engineer J. M. Robertson of Montreal, has been making tests and will prepare estimates of the water power at Marble Rock on the Gananoque river, with a view to generating power for this town.

The Light Committee will take up the matter of a new contract with the Electric Light Company for the purchase of their plant.

Goderich, Ont.

The town is negotiating with the Bell Telephone Company for an extension of the Bell franchise. The town offers an extension of three years for an annual

payment of \$200, and the supplying of six free telephones for municipal use.

Grenfell, Sask.

The Rural Telephone Co., sec.-treas., M. S. Deason, are contemplating the erection of a telephone building and will extend their lines through the country.

Hamilton, Ont.

Mr. John Patterson has been granted an extension of his franchise for the Hamilton, Waterloo & Guelph Railway until October 1st.

Tenders have been received for four synchronous motors for pumping plant.

It is stated on good authority that the electric interests represented by Sir Wm. Mackenzie and his associates have not taken over the control of the Dominion Power & Transmission Company's varied electrical operations in and around Hamilton.

Halifax, N.S.

The employees of the Halifax Tramway Company are asking the government for the appointment of a conciliation board to decide the question of wages. They are asking an advance in the wage schedule to the following amounts: first year 21c, second year 23c, third and after 25c.

Humboldt, Sask.

It is reported an electric light plant and waterworks system will be installed.

Ingersoll, Ont.

There is an agitation to allow the Bell Telephone Company to take over the Independent Telephone Company of this place and in this way do away with the duplication of telephones, which is found unsatisfactory by the citizens.

Kindersley, Sask.

Tenders have been called by the John Galt Engineering Co., Winnipeg, for electric light and power plant equipment.

Kamloops, B.C.

The street lighting contract has been awarded by the town council to Hutchinson Bros., Victoria, B.C.

Kingston, Ont.

It is understood that the city electric light service will be extended to the municipality of Portsmouth, which village will grant the city a franchise.

Tenders are called by the city of Kingston for a 500 kw. unit complete.

The report of Mr. R. S. Kelsch, consulting engineer of Montreal on the power situation in Kingston advises that the offer of neither the Hydro-electric Power Commission of Ontario, at \$36 per h.p. nor the offer of the Electric Power Company at a somewhat lower rate, be accepted, and advises the installation of a steam or similar plant by the city authorities. It is understood that a 500 kw. steam turbo-generator will accordingly be purchased.

London, Ont.

The London Street Railway Company has commenced work at the corner of Wellington street and Cheapside, on the Cheapside street extensions.

Moose Jaw, Sask.

The first annual meeting of the shareholders of the Moose Jaw Street Railway Company held recently indicated that the operation of the system had been satisfactory from a financial point of view. Mr. A. A. Dion, Ottawa, president, stated that three new cars would be in operation in the course of a few days, having been already shipped by the Ottawa Car Company. It was also stated that a Diesel oil engine-generator of 500 kw. capacity was on order.

Montreal, Que.

The Mead Electric Company, Ltd., has been incorporated with capital of \$50,000, to carry on business as electrical engineers and contractors.

The General Chemical Produce and Explosive Co. has been incorporated with half a million capital to carry on an electro-chemical business.

Nelson, B.C.

The city council have made an offer to the Nelson Street Railway Company of \$7,500 for their total assets.

North Toronto, Ont.

The by-law asking authorization of the agreement with the Toronto and York Radial Railway Co. was rejected by the ratepayers.

The Privy Council of England have just announced their ruling in connection with the case involving the stringing of high tension transmission lines along Eglinton avenue and across Yonge street. The Privy Council decision finds that the Toronto Power Company has power to construct this line without consulting the municipality.

Ottawa, Ont.

The question of joint development of the Chats Falls power on the Ottawa River is being considered by representatives of the Ontario and Quebec Governments.

It is reported that the Ottawa & St. Lawrence Railway Company will connect with Kingston through Perth, Lanark, Merrickville and other towns and that work will commence in the near future.

Owen Sound, Ont.

Excavations have been commenced for the Northern Bolt & Screw Company's factory. It is stated about 150 h.p. of electrical energy will be required which may either be supplied from the town plant, or by a private installation.

Port Colborne, Ont.

The Ontario Power Company is reported to be planning to erect a transformer station here.

Paris, Ont.

A by-law to purchase \$25,000 debentures of the Lake Erie & Northern Electric Railway passed.

Port Dover, Ont.

By-law to purchase \$25,000 debentures of the Lake Erie & Northern Electric Railway passed by a large majority.

Port Arthur, Ont.

A report of electrical operations for the first quarter of the current year shows that the telephone service has

New WESTON INSTRUMENTS

A Full Line of Alternating Current Switchboard Indicating Instruments

is offered by this Company, comprising:

**WATTMETERS, Single and Polyphase.
POWER FACTOR METERS.
SYNCHROSCOPES.**

**FREQUENCY METERS.
VOLTMETERS.
AMMETERS.**

and New Models of Weston D.C. Instruments to match

This whole group of instruments embodies the results of several years exhaustive study and scientific investigation of all the complex electrical and mechanical problems involved in the development of durable, reliable, sensitive and accurate instruments for use on alternating current circuits.

Every detail of each of these instruments has been most carefully studied and worked out so as to be sure that each shall fully meet the most exacting requirements of the service for which it is intended. Neither pains nor expense has been spared in the effort to produce instruments having the longest possible life, the best possible scale characteristics, combined with great accuracy under the most violent load fluctuations and also under the many other trying conditions met with in practical work. Every part of each instrument is made strictly to gauge and the design and workmanship and finish is of the highest order of excellence.

We invite the most critical examination of every detail of each member of the group. We also solicit the fullest investigation of the many other novel features and very valuable operative characteristics of these new instruments and request a careful comparison in all these respects with any other make of instrument intended for like service. We offer them as a valuable and permanent contribution to the art of electrical measurement. Their performance in service, will be found to justify the claim that no other makes of instruments approach them in fitness for the service required from A.C. Switchboard indicating instruments.

Full particulars of design, construction, prices etc., are given in Catalogue E. N. 16. Write for it.

WESTON ELECTRICAL INSTRUMENT CO.

Main Office and Works, Newark, N. J.

New York, 114 Liberty St.
Chicago, 1504 Monadnock Block.
Boston, 176 Federal St.
Philadelphia, 342 Mint Arcade.
Birmingham, Brown Marx Bldg.
Detroit, 44 Buhl Block.

St. Louis, 915 Olive St.
Denver, 231—15th St.
San Francisco, 682 Mission St.
New Haven, 29 College St.
Cleveland, 1522 Prospect Ave.

Paris, 12 Rue St. Georges.
Berlin, Genest St. 5 S. hoenberg.
Mexico, 2, a C. puchinas 40.
London, Audrey House, Ely Pl.,
Holborn

Toronto, 76 Bay Street.
Montreal } The Northern
Winnipeg } Electric &
Vancouver } Manufacturing
Calgary } Company

HEAD OFFICE:
PRESCOT, ENGLAND

Paid up Capital \$8,500,000.00

WORKS:
Prescot, Helsby and Liver-
pool, England

British Insulated and Helsby Cables Limited

POWER CABLES

For Working Pressures up to

30,000 Volts

Sole Canadian Representatives:

Canadian British Insulated Company, Limited

Cablegrams "Insulator" Montreal
Telephone Main 1521, Montreal

Power Building, Montreal

about \$100 to its credit, the electric light something over \$6,000 and the power system something over \$800. These utilities are all municipally operated.

Penticton, B.C.

The town council has closed a contract with the Okanagan Telephone Company by which the company promises, among other things, to install the "lock-out" system on all party lines, such lines to have not more than ten instruments on any one line. The rates are to be as follows: business 'phones \$4.00 a month, private 'phones \$2.00 a month, and party lines, \$1.50 to \$2.00.

Quebec, Que.

The power plant of the Jacques Cartier Electric Company was completely destroyed by fire on the morning of July 16th. The plant had development capacity of about 2,000 h.p. and was controlled by the Quebec Railway, Light, Heat and Power Company.

Regina, Sask.

For the week ending July 13th the street railway returns amounted to \$2,246.85, a record for the system's operations to date.

The Saskatchewan Government has engaged Mr. R. O. Wynne-Roberts to investigate the possibilities of the lignite coal fields of the province for developing electric power for the various towns and cities.

St. Catharines, Ont.

The Ritter Illuminating & Manufacturing Co. has been incorporated with a capital of \$75,000 to manufacture and deal in electrical apparatus and appliances.

Stratford, Ont.

The city council and the Board of Trade of this city are using their influence with the government to obtain approval of the form of agreement drawn up between the city and the Stratford Railway Company, which allows the company to obtain power from any source they desire. The government has been holding up the proposition because the condition that power shall be obtained from the Commission only, is not included.

St. Thomas, Ont.

The St. Thomas Street Railway Co. have awarded to the Dominion Wire Co. contract for wire, and to the Traction Material Co., New York, contract for three new coaches.

Scotstown, Que.

The Emberton Lumber Co. is reported to be reconstructing their power house.

Saskatoon, Sask.

Good progress is being made in the grading and laying of rails for the municipal railway system now being installed in this city. Arrangements are being discussed by which the street railway may be able to carry on a freight and other transfer business to serve industrial sites in different parts of the city.

Simcoe, Ont.

By-law to purchase \$25,000 debentures of the Lake Erie & Northern Electric Railway Company passed.

Sarnia, Ont.

In the recent fire which destroyed much of the apparatus of the Sarnia Gas & Electric Co. and the Sarnia Street Railway Co. the latter lost two generators which were situated at the plant

of the electric company. The Railway Company has two generators on order but in the meantime equipment has been obtained from the D. U. Ry. and the cars are operating satisfactorily.

Toronto, Ont.

Street Railway receipts for June were \$445,000 approximately, of which the city receives about \$69,000.

The new Street Railway wage scale of the Toronto Street Railway Company gives first year men 23½c., second year men 25½c. and third and succeeding years 27½c. as compared with 21, 23 and 25c. respectively, or an increase all round of 2½c. an hour. An extra rate of 4c. per hour will be paid for Sunday work.

A winding up order has been issued by Mr. Justice Kelly in connection with the Dominion Telephone Manufacturing Company of Waterford. The order is made by request of the Canadian General Electric Company.

It has been stated that the Hon. I. B. Lucas will spend some time during his visit in Britain, studying the government-owned telephone situation there. This may be taken as an intimation that the Ontario Government has the question of public ownership of telephones under consideration.

Vancouver, B.C.

A destructive fire on the morning of July 20th caused damage to the extent of some half million dollars. Among other valuable property the car barns of the B.C.E.R. company were destroyed.

Winnipeg, Man.

R. L. Barry, formerly manager of the Tri-State Telephone Company of Minneapolis, has been appointed to take charge of the telephone system of the

Moonlight Schedule for August, 1912

Courtesy of the National Carbon Company, Cleveland, Ohio.

Date.	Light.	Date.	Extinguish.	No. of Hours
Aug 1	7 40	Aug 1	10 40	3 00
2	7 40	2	11 00	3 20
3	7 40	3	11 20	3 40
4	7 40	4	11 40	4 00
5	7 40	5	0 10	4 30
6	7 40	6	0 40	5 00
7	7 40	7	1 20	5 40
8	7 30	8	2 10	6 40
9	7 30	9	3 20	7 50
10	7 30	10	4 20	8 50
11	7 30	11	4 30	9 00
12	7 30	12	4 30	9 00
13	7 30	13	4 30	9 00
14	7 30	14	4 30	9 00
15	7 30	15	4 30	9 00
16	7 20	16	4 30	9 10
17	7 20	17	4 30	9 10
18	7 20	18	4 30	9 10
19	7 20	19	4 30	9 10
20	7 20	20	4 30	9 10
21	10 30	21	4 30	6 00
22	11 20	22	4 30	5 10
23	0 20	23	4 40	4 20
24	1 20	24	4 40	3 20
25	2 20	25	4 40	2 20
26	No Light	26	No Light	
27	No Light	27	No Light	
28	7 10	28	9 10	2 00
29	7 00	29	9 30	2 30
30	7 00	30	9 50	2 50
31	7 00	31		

Total.....171 50

Manitoba Government, succeeding the Board of Commissioners of three members, resigned. It has been decided that the general rates in Manitoba will not be raised though it is understood Winnipeg rates will be increased 20 per cent.

P. W. SOTHMAN J. A. BRUNDIGE
F. P. MANSBENDEL
P. W. SOTHMAN & CO.
ENGINEERS
Hydro-Electric Development
High Tension Power Transmission
Superintendence and Management
KENT BUILDING TORONTO

Condensed Department

RATE

Positions Wanted } 2 cents a word per inser-
Positions Vacant } tion.
Miscellaneous. }

Tender advertisements, equipment for sale, etc., 15 cents per agate line (14 agate lines make one inch) per insertion.

Advertisers who wish to conceal their identity may do so by using an Electrical News box number without extra charge.

Forms close on the 18th of each month.

Situations Wanted

Position wanted as Manager or Superintendent of small plant. Ten years experience. Excellent references. Box 523 Electrical News.

For Sale

Ayr electric light plant in first class condition, steam power, good service and contracts. Exclusive franchise in town of 1,200. A splendid chance for a practical man. Being sold because of owner's death. Apply D. M. Clark, 15 Mc Kenzie Crescent, Toronto, Ont. 2-TF

Patents For Sale

The proprietors of Letters Patent No. 127080 relating to "Process of Manufacturing Iron Electrodes for Use in Alkaline Accumulators," and No. 127081 relating to "Active Masses for Positive Electrodes of Electric Elements, etc.," desire to dispose of the Patents or to grant Licenses to interested parties at reasonable terms with a view to the adequate working of the Patents in Canada.

Inquiries to be addressed to the actual proprietors, Svenska Akkumulator Aktiebolaget Lungner, Stockholm, Sweden.

Opportunity

With the great protection of duty afforded Canadian manufacturers of electrical goods, coupled with the fact that there are practically no switchboards or panel boards made in Canada, most of this material now being imported, we are in position to offer a wide-awake man the chance of a life time. We are electrical contractors in the States, and have also carried on the manufacturing of panel boards, metering boards and cabinets, but owing to the conflicting nature of the two, we have decided to abandon the manufacturing business. We, therefore, offer for sale our entire plant, consisting of machinery, dies, tools, copper, slate, raw, semi-finished and finished material, templates, cost records, drawings, cuts for catalogues, etc. We will dispose of this as a whole at a sacrifice and on a cash basis.

Apply Box 505, Electrical News, Toronto, Ont. 6-8



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P R O D U C T S

WE control the Canadian rights for the celebrated lamp for which the Brush Electrical Engineering Company is famous.

METALLUM

The lamp with a reputation won in service.

May we send you a little booklet called
"LIGHT BILLS GOOD-BYE"

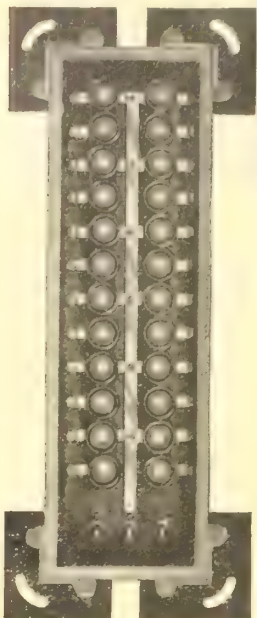
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Superior Electric Mfg. Co.

The "Superior" Way



Better than any other way

MANUFACTURERS OF

Narrow Type Panel Boards
Switch Boards
Electrical Distributing Apparatus
Steel Cabinets

Write for our NEW 1912 CATALOG

2416-18 University Ave., S. E.

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This New Iron Will Stimulate Large Sales

Your sales of

Economic Heating Appliances

will receive an added impetus if you offer **this New Iron**. It is certainly the most perfect model that has ever been produced. All the old drawbacks of earlier models have been overcome. It consumes 20% less energy at a given heat than any other Iron on the market. It will **never** burn out. Rated voltage 110 v. tested for 20 minutes at 220 v. The most serviceable and economical electrical appliance ever made.

The new electric 3 heat disc stove is most carefully constructed to give the greatest heat at the smallest working cost. It is strongly made and beautifully finished, it will never break or burn out.

Royce Electrical Economic Heating Appliances are luxuries within the reach of **all**—the busy hostess, college girl, maid or bachelor. The time, money and trouble they save, the dirt and danger they do away with will make them the most popular Heating Appliances for your season's trade.

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Write to-day for illustrated catalog and Agency terms.

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Clamps, Insulators,
Twist Splice
Connectors,
Split Tinned
Connectors

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The Chicago Conduit Rod Coupling

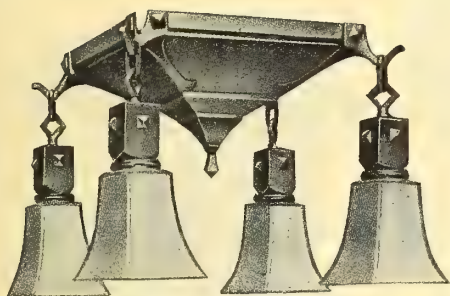
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Best answers
the purpose
for a device
of its kind
and the
price is
right



Used
by leading
Lighting, Trac-
tion and Telephone
Companies in the
United States and Canada
who have recognized its superior
construction and adaptability.
This coupling makes a joint that is a
joint—not merely a hook connection.
Write for descriptive folder and prices.

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1704

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LIGHTING FIXTURES and LIGHTING UNITS
that appeal to every class of trade.

CONTRACTORS, DEALERS, CENTRAL STATIONS,
endorse Tungstoliers because they are perfect in design,
finish and workmanship and properly priced.

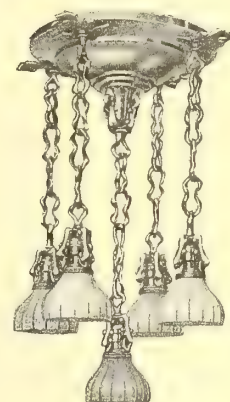
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CATALOGS,—10A, 20A, 30, 40, 100, 110A.

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1535-B



Style No. 33 Wall Bracket

GAIL-WEBB MANUFACTURING CO.

Manufacturers of All Kinds of ADJUSTABLE ELECTRIC FIXTURES

Desk and Floor Portables, Wall Brackets, Ceiling,
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ALUMINUM

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Bus Bars
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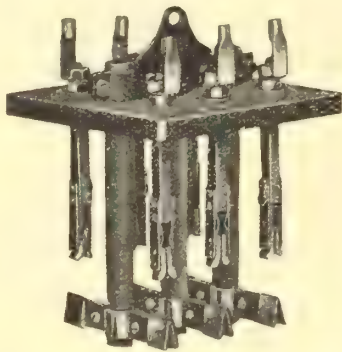
Northern Aluminum Co.

1503-4 Traders Bank Bldg. TORONTO Limited

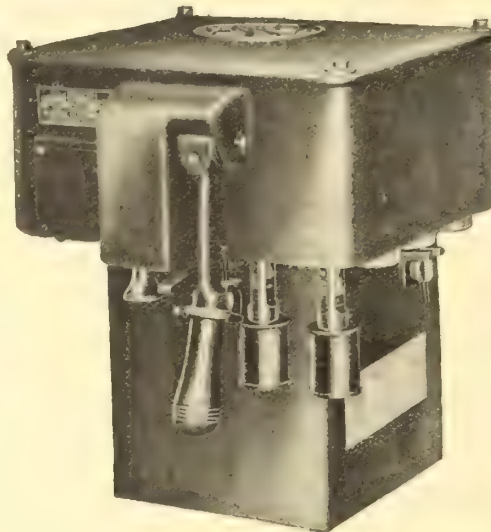
The New K 20 Oil Switch

---What it means to the Plant

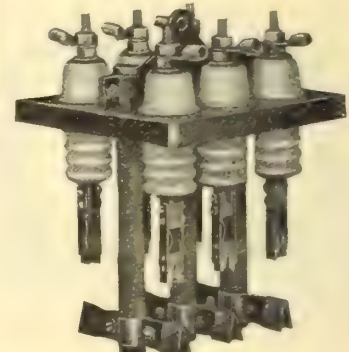
RELIABILITY, SAFETY AND DURABILITY



Contacts, insulation and terminals
for 600-Volt Switch.



Type F. Form K-20 Oil Switch complete with
automatic overload and low voltage release.



Contacts, insulation and terminals
for 2500-Volt Switch.

The C. G. E. "K-20" Oil Switch was designed specifically to meet the exacting conditions which are experienced in textile and flour mills, woodworking plants, powder works, coal mines, gas works, oil refineries or in any industry where there are inflammable materials or explosive gases.

It is *simple, compact* and *durable*.

It is entirely enclosed and perfect in every single detail.

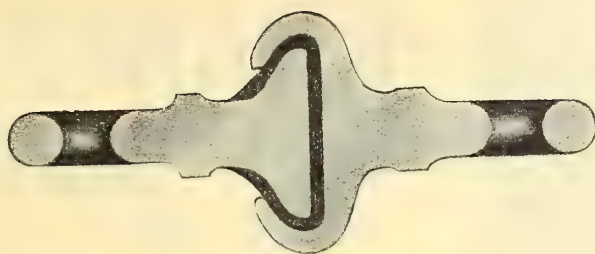
Made in capacities up to 300 amperes and 2500 volts and can be furnished with different combinations of automatic tripping devices to meet a wide variety of operating requirements.

Complete information and prices are given in Bulletin 4911, a copy of which will be gladly supplied upon request.

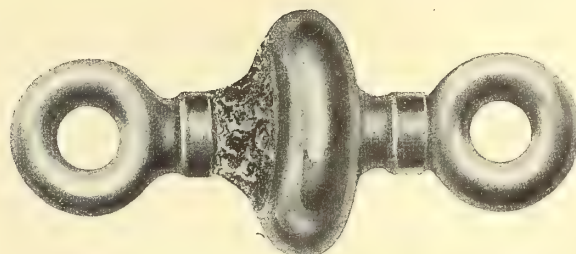
Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt South Porcupine Winnipeg Calgary Vancouver
Nelson Prince Rupert

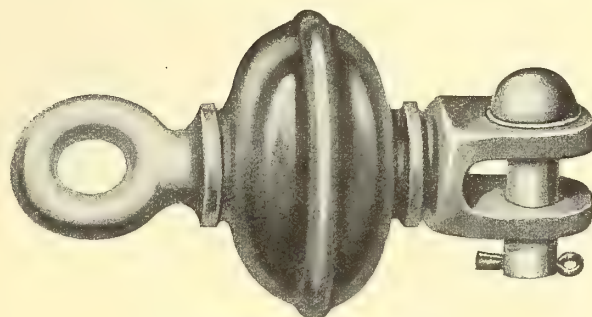


Section showing insulated joint



Insulator without compound

Giant Strain Insulators



Complete-Strain Insulator

A perfect mechanical and electrical strain insulator.

Only sheet **mica under compression** is subjected to mechanical and electrical stresses.

The insulated joint is protected from the weather by **non absorbent** insulating compound.

The mechanical strength of the C. G. E. Giant Strain Insulator is limited only by the strength of the metal eyes or clevises.

All metal parts are **sherardized**.

Every insulator is tested before shipment.

2" diameter	-	-	2500 lbs.
2⁵/₈" diameter	-	-	4000 lbs.
2" and 2⁵/₈" diameter	-	-	5000 volts.

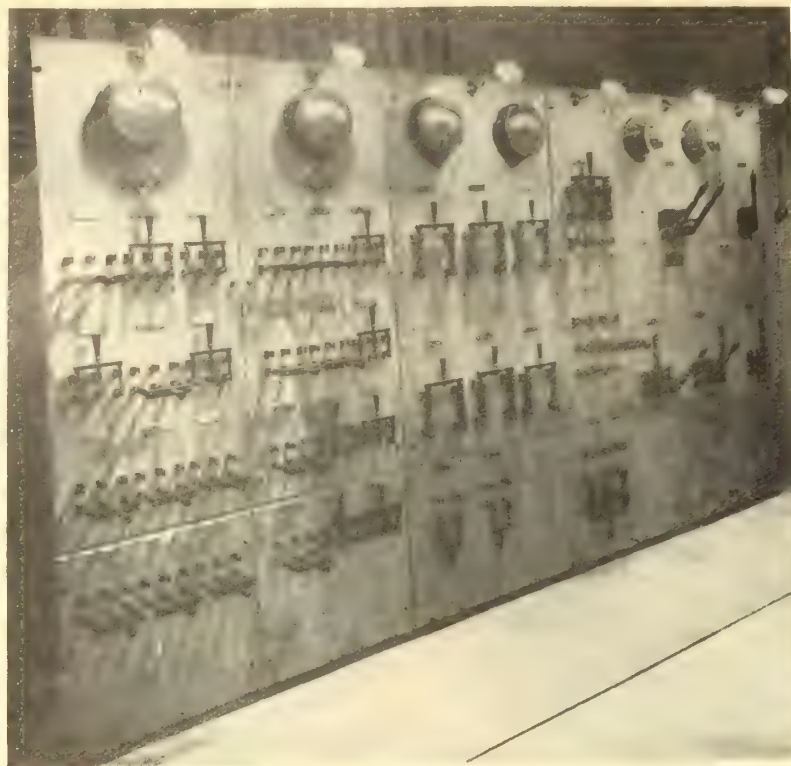
These insulators are supplied with large or small eyes or clevises in any combination.

Large stocks are now at our local offices ready for immediate shipment.

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Are the make used in many of the largest institutions, office and government buildings in the United States and Canada.

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Household Iron Weight 6 Pounds.



The "IDEAL HEAT" iron sells almost at sight to every woman.

Its beautiful lines, perfect balance and workmanship and its easy working weight make it a favorite with the women.

And to back that quality up it does perfect work at all times. Its heating element is the most perfect yet made—guaranteed for five years.

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Send us your next order and be
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Let us demonstrate the manner in
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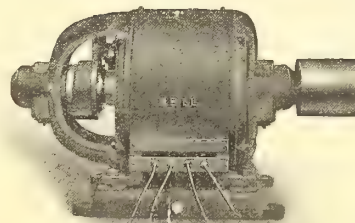
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"BELL" High Efficiency Single Phase Motors

Meet All Requirements



Large stock carried
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IN B. C., IDAHO AND WASHINGTON. WE SHIP FROM OUR

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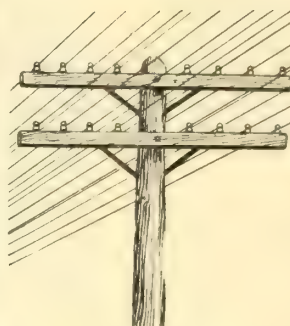
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Clock movement improved, powerful, built in our own factory.

Fly wheel operates switch. Released by Trip Hands on clock dial coming in contact with Trip Lever.

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Porcelain Bushings, extension of the switch porcelain. Leads entering at bottom exclude moisture.

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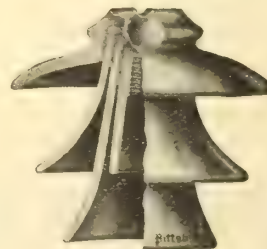
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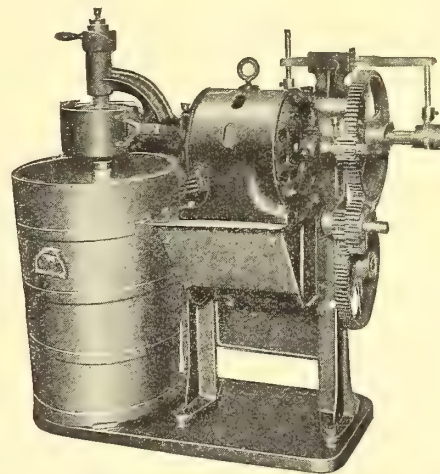
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in life, strength and appearance are all that telephone buyers can ask. Price is O. K. Write
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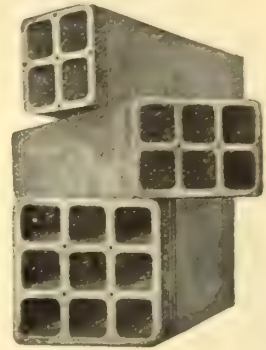
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**Multiple and Single Duct Conduit for
Underground Work**

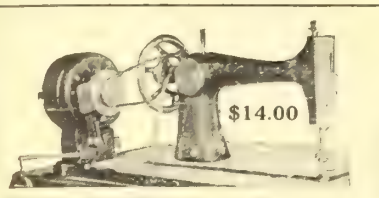
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Household and Factory Sewing Machine Motors



Motor equipment will fit any make sewing machine. Costs only quarter cent per hour for current to operate it, in household size. Motor starts and stops automatically with treadle by means of a patented switch located in base. Speed of sewing machine is varied by the

pressure of the foot on the treadle. The simplest, the most durable, the cheapest to operate and last but not least, the cheapest in price.

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Just back up that live advertising you are doing with Wakefield Standard Universal Lighting Fixtures. Show the prospect the intrinsic values not found in other lines for the same money and he will install Wakefield and YOU will be the richer because they are INTERCHANGEABLE and you won't have to carry much investment to have a nice assortment, and because they are STANDARD you will save a lot of time wiring and installing.

Catalogue ?

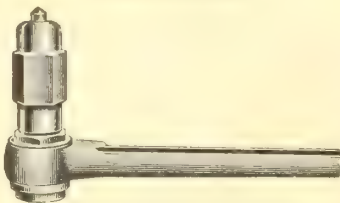
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F. W. Wakefield Brass Co.

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"GIANT" Railroad Track Ratchet

(SINGLE ACTING)

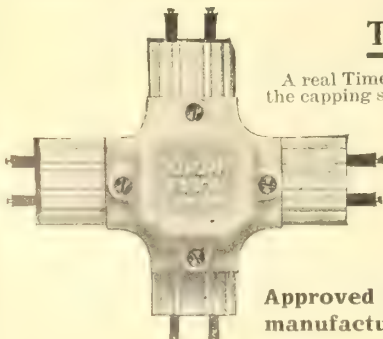


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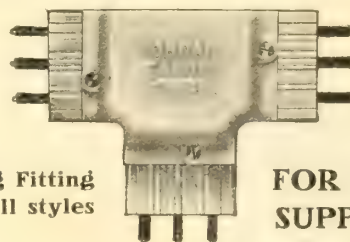
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A real Time Saver which means a Money Saver, making the best class of work. It is not necessary to have the ends of the capping straight as the cover of the Tap-on overlaps the capping, thereby covering any bad ends of capping.



Approved Moulding Fitting
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Rubber Covered Wires and Cables

For Power, Light and Telephone Work

INCANDESCENT LAMP CORD
FLEXIBLE SWITCHBOARD CABLES

Special Cords and Cables for all kinds of Electrical Work

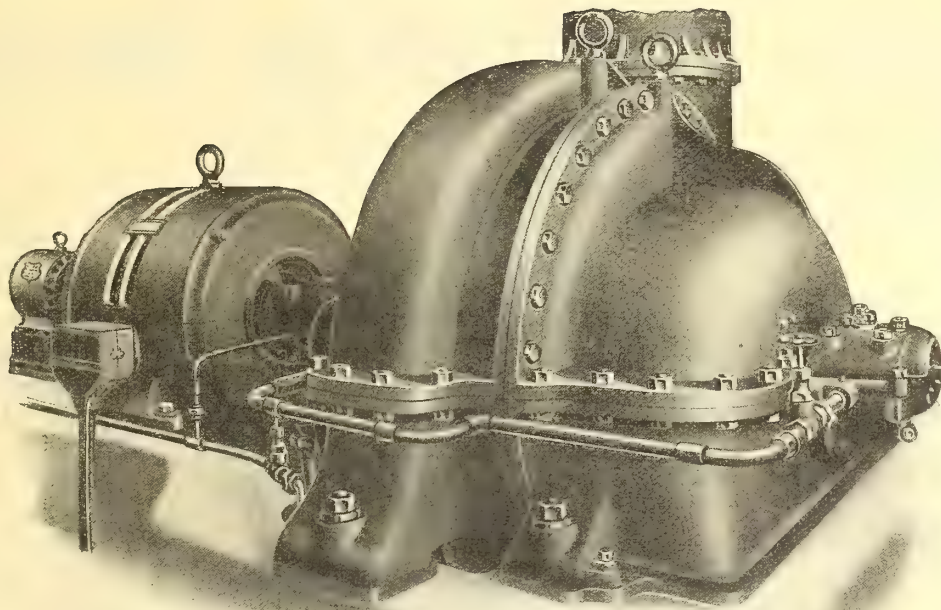
Prompt Shipments from Canadian Factory

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The Lancashire Dynamo & Motor Company
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The "JUST" TUNGSTEN. One customer of ours reports that on 250 Tungsten Lamps, burning 2 M hours only eleven had to be replaced. Send for a trial dozen at case lot prices.

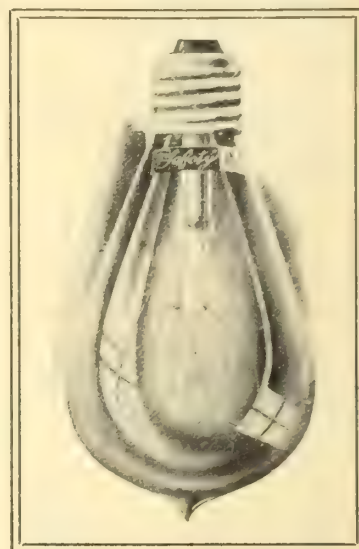
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A lamp that will meet class A specifications. Can furnish either 3.1, 3.5 or 4 watts per candle. Try an assorted lot at our case lot price 13 cents. This is certainly a splendid lamp.

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"Hot Point" Heating Appliances, "Brookduct" (Flexible Conduit)
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Be sure you write us to-day before you forget, if in a hurry phone at our expense.



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Long Distance Phone, M. 2768

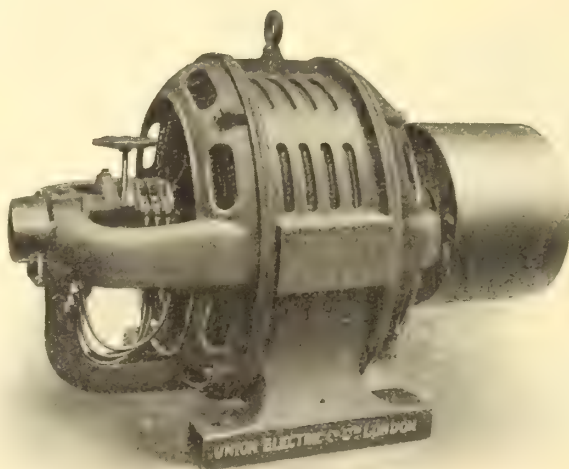
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Made in a factory that devotes
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The design is the result of long
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The material used is the
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Size 100a. 70 B. H. P. Slip Ring.

Rated for continuous use at the
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Ample strong to stand rough
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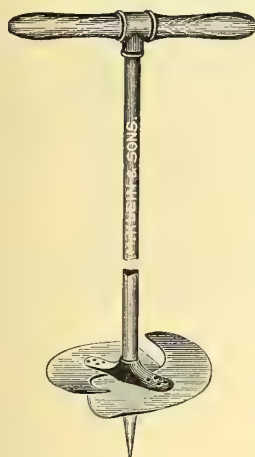
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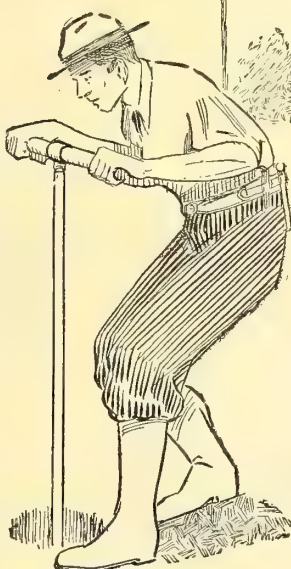
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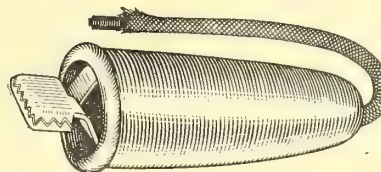
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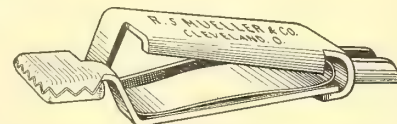


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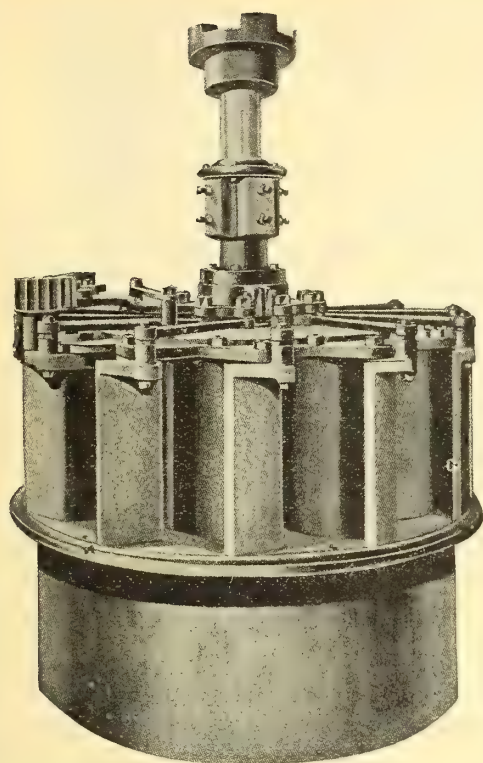
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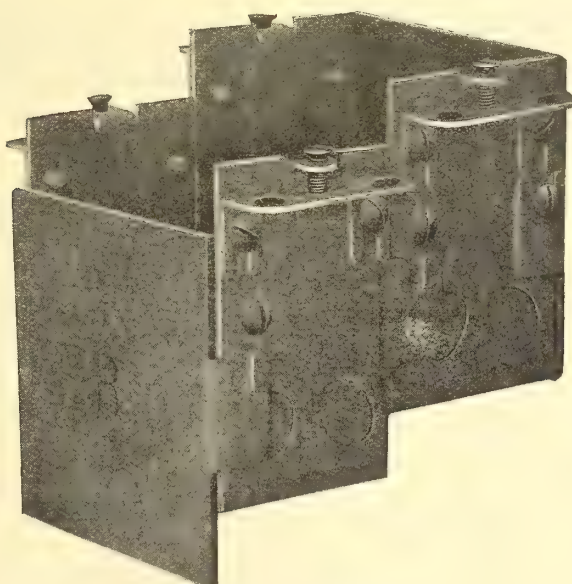
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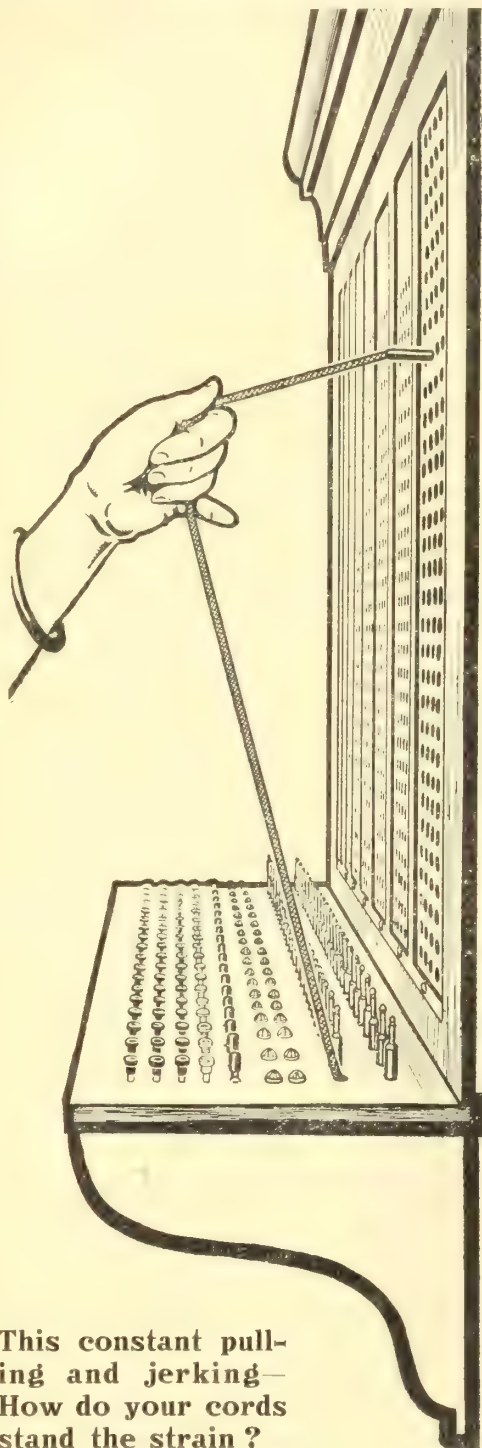
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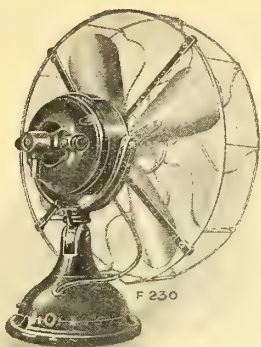
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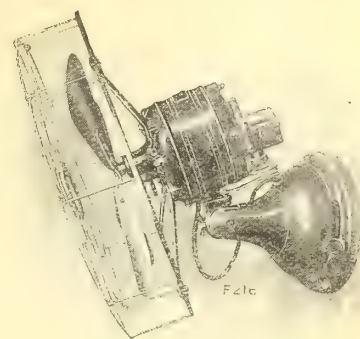
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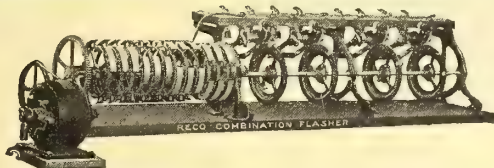
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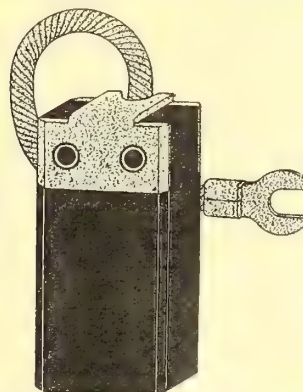
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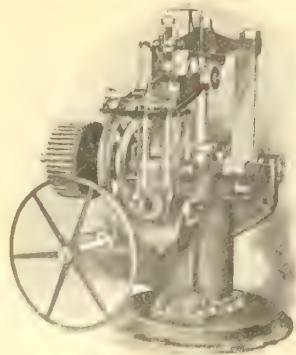
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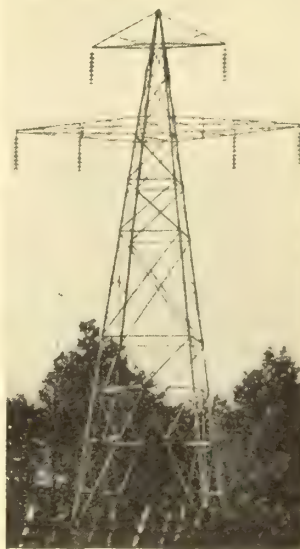
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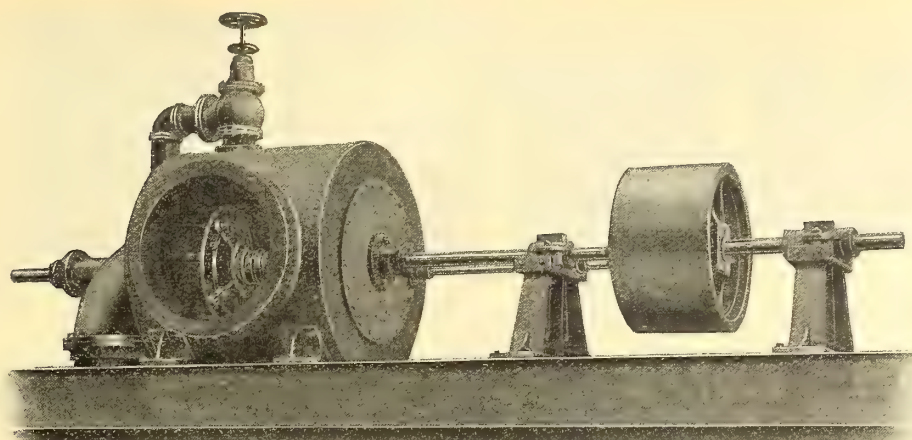
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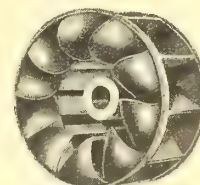
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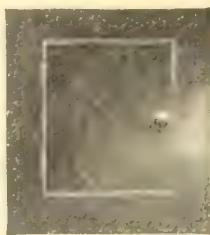


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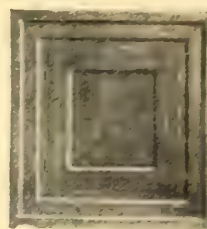
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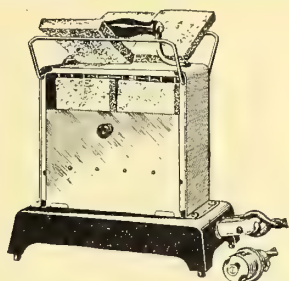
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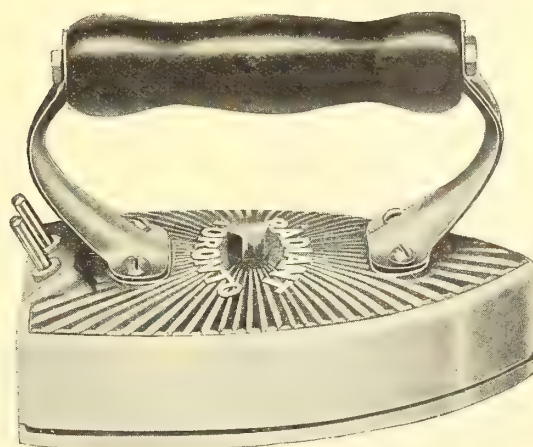
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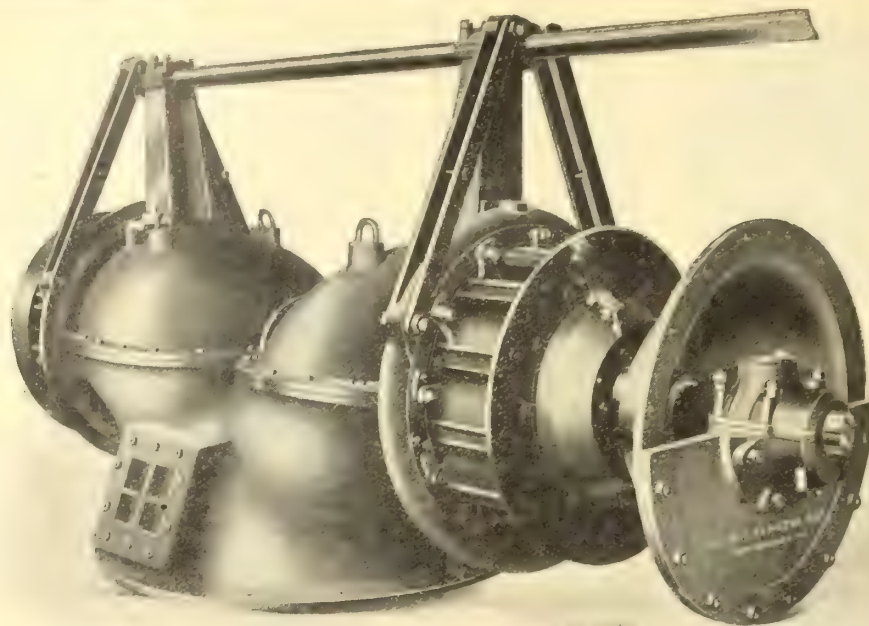


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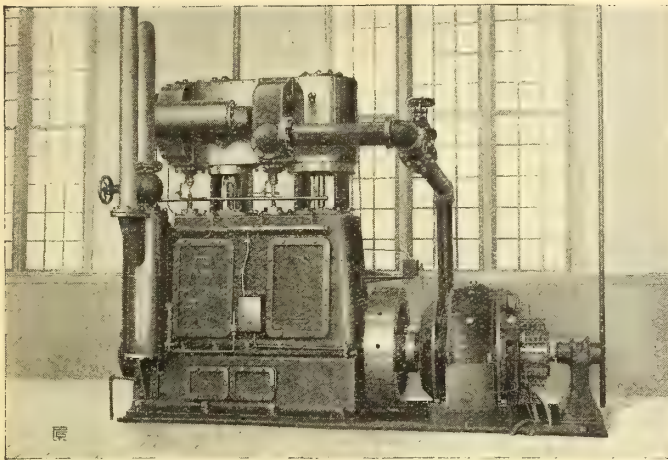
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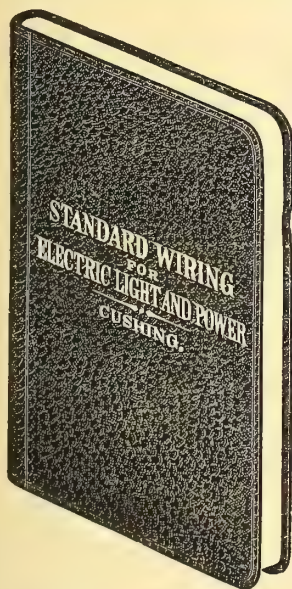
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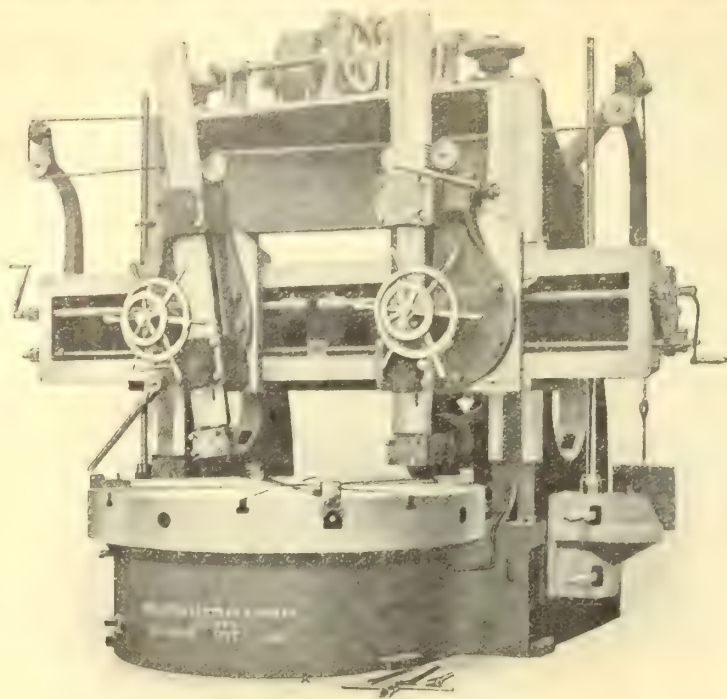
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Pocket Size

Electrical News, 220 King Street West Toronto, Canada

"The Best Book on Wiring Ever Produced"—E. T. BIRDSALL, M.E., A.I.E.E.



Bertram Boring and Turning Mills

Manufactured in sizes
from 42 to 100-inch swing.

The illustration shows 72-
inch Vertical Boring and
Turning Mill, motor driv-
en, with a separate motor
for raising and lowering
the crossrail.

Write for particulars to

The John Bertram & Sons Co., Limited
DUNDAS, ONTARIO, CANADA

Sales Agents: The Canadian Fairbanks-Morse Company, Limited.

We invite
inquiries for
prices on Gal-
vanized Strand
Telephone
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Lowest prices
Prompt shipment



We supply
Wire which
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proved of by
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We also manufacture the following lines used in connection with this work:—

Cross Arm Braces, Through and Machine Bolts, Pole Steps, Washers,
Wood Screws, Lag Screws, Wire Nails.

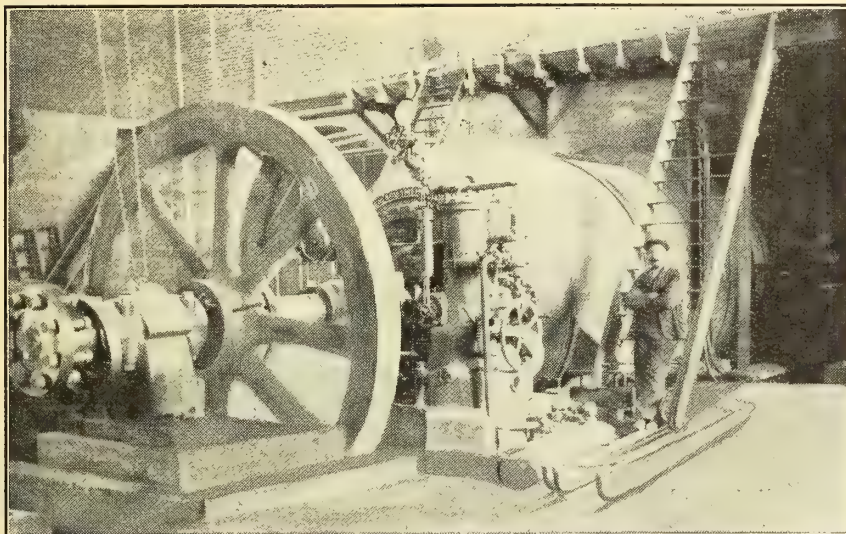
The Steel Company of Canada Limited

Hamilton

Montreal

Toronto

Winnipeg



The illustration shows one of the two 3,750 B.H.P. Turbines and Oil Pressure Governor Supplied to the Calgary Power Co.

Turbines

— and —

Governors

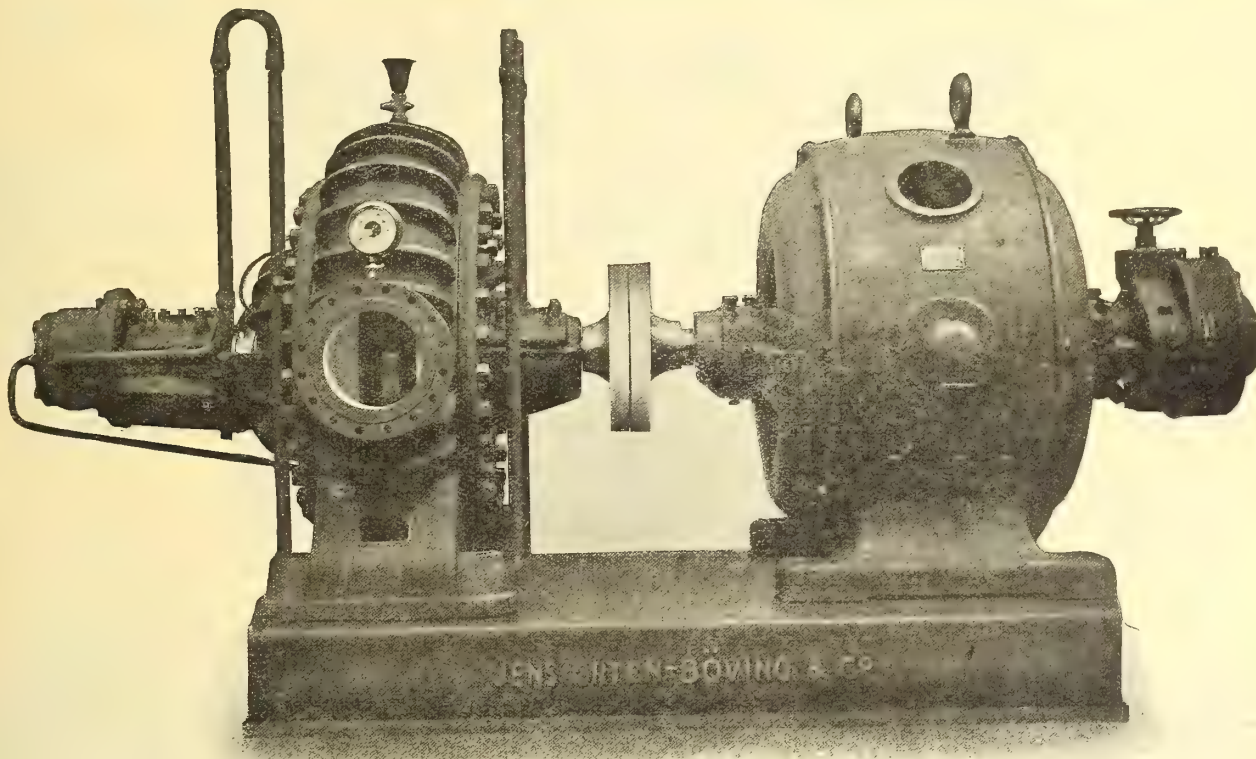
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Governors Made

Suitable for All Conditions

No Racks No Gears

Absolutely Self Contained

TURBO PUMPS FOR HYDRAULICING



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HEAD 415 FEET—CAPACITY 4,000 IMP. GALS. PER MIN.—710 B.H.P.

For Further Particulars Apply to:—

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PIPE 164 Bay Street, TORONTO **LINES**

Vancouver Office: 448 Seymour St.

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and Interurban
passenger cars.
Electric ex-
press cars and
locomotives.
Snow sweep-
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and work cars.



Car Seats,
Car Curtains,
and a very
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of Brass and
Bronze Car
Fittings.

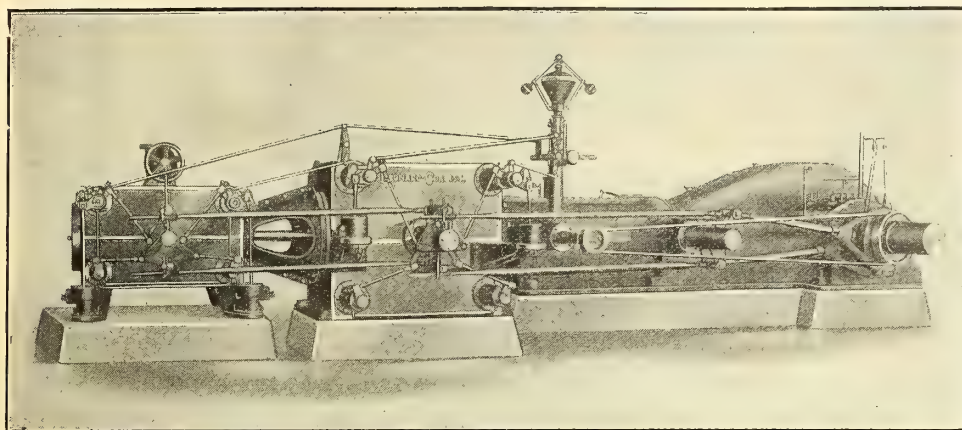
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as they are at your service for
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for Medium and
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100 to 235 R.P.M.

Built in Units up
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Power

These engines are
Absolutely Noiseless,
are of **Massive Design**
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The **Frame**, including guides and main bearing, is cast in one solid piece, thus insuring greatest rigidity. **High Economy** is the particular feature of this engine.

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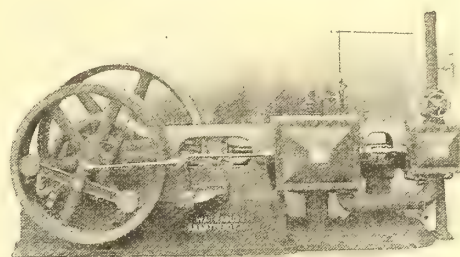
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Uniform Speed with Varying Load



We not only promise this with the McEwen Engine but we *guarantee* it. Read this: "The engine shall not run one revolution slower when fully loaded than when running empty, and a reduction of boiler pressure from the greatest to that necessary to do the work will not reduce the speed of the engine one revolution. Any engine failing to meet this guarantee becomes the property of the purchaser upon the payment of one dollar."

This guarantee is issued with every McEwen Engine we sell and we have never been asked to meet it yet.

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This closeness of regulation combined with exceptional strength and simplicity make the McEwen Automatic an ideal engine for the economical and safe development of electric power for the isolated plant.

The Waterous Engine Works Co., Limited, Brantford, Canada



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A good showing of beautiful electric ware helps to a big showing in the cash drawer

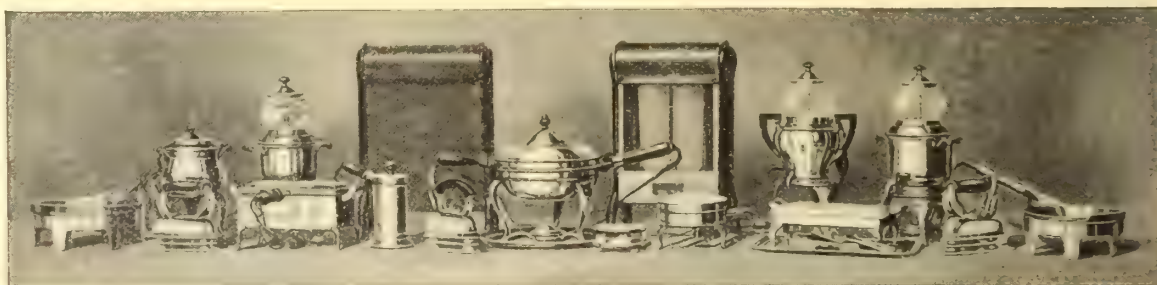
Perhaps you'll admit this, but beautiful ware does not necessarily mean quality ware.

The central station or dealer who is already alert to the big demand for, and the consequent profit from, electric household ware, must remember the very important fact, that they are practical and economical only when designed and built by an experienced organization. The name—

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will introduce and put the O. K. stamp upon any product which it exemplifies. Be governed by it when stocking electric household devices—Electric Irons, Toaster Stoves, Chafing Dishes, Percolators, Samovars, etc. A complete line of Westinghouse Quality electric ware is ready for you and those whom you serve.

*Get information regarding our dealers helps, advertising, etc.
We work with you to our mutual advantage.*



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Toronto	Montreal	Halifax	Winnipeg	Calgary	Vancouver
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Quick Thorough Repairs to all makes of Electrical Apparatus.

Remote Control Solenoid Switches for economical tungsten or incandescent street lighting from existing house lighting system.

The Best Carbon Brushes in America for Electrical Machinery.

Used Electrical Machinery of all descriptions.

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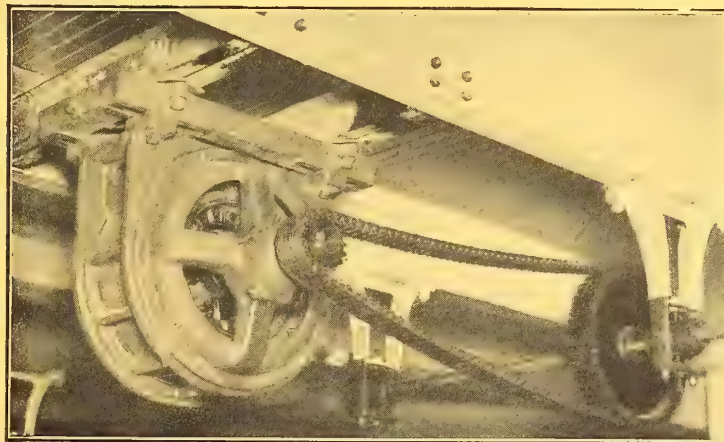
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35 H. P. Chain Drive with Motor Bolted to Ceiling

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Above illustration shows one of the Chain Drives in the new works (COMPLETELY EQUIPPED with HANS RENOLD SILENT CHAIN) of one of the **Largest Manufacturers in Canada.**

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(REGISTERED)

**Sole Canadian
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We can KEEP YOU RUNNING while we make your Repairs.

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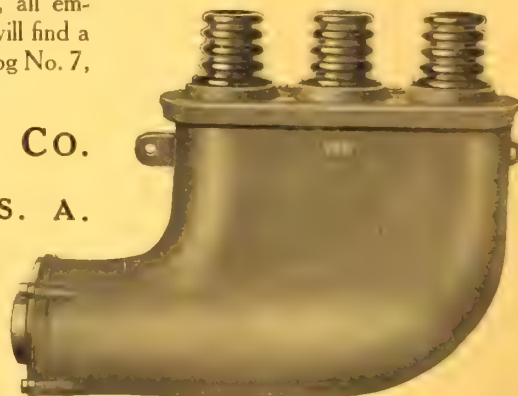


Insure your service against breakdowns and losses resulting therefrom. G & W ELECTRIC SPECIALTIES are the result of many years of practical Central Station experience and demand. They are designed by practical Electrical Engineers who know how to best meet these demands. By the use of G & W Pot Heads you can

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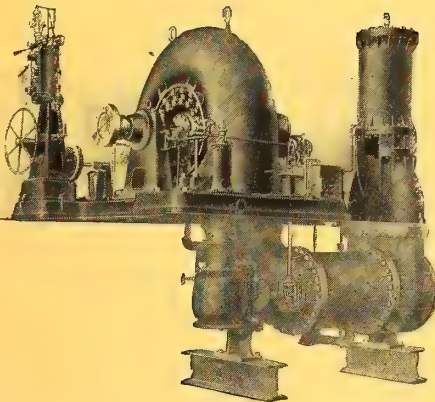
of your system. One device performs the functions of two or more, thereby giving you not only a most efficient installation, but also a most economical one. Many new devices are being brought out by this company as modern practice demands them, all embodying the now famous G & W characteristics. You will find a number of these illustrated and described in our new Catalog No. 7, Ask us to send you a copy.

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Electrical News

Generation, Transmission and Application of Electricity



HYDRAULIC TURBINES

One of three units each of
1700 26 H. P. at 720 R. P. M. 280 ft. Head

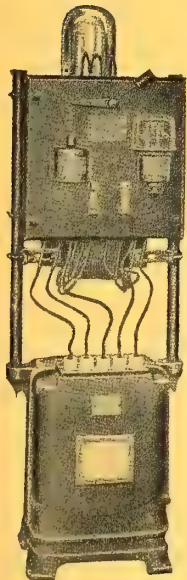
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Moving Picture
Rectifier

Mercury Arc Rectifiers

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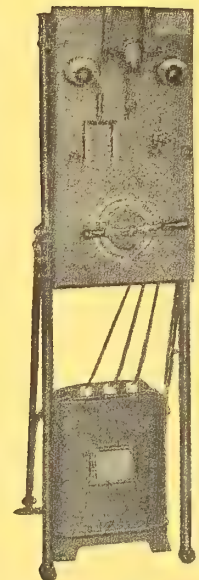
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Will deliver direct current wherever alternating
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Canadian General Electric Co., Limited

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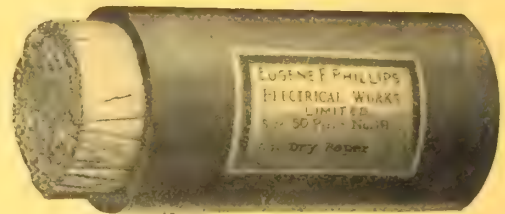
PHILLIPS



Bare and Insulated Copper

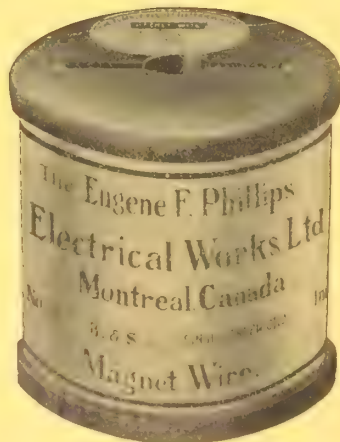
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For Telephone, Telegraph, Lighting,
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Bare and Insulated Electric Wire and
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Weatherproof Magnet
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When you need the goods you want them

Save yourself the worries and delays you experience in importing goods from other countries

We Manufacture and Carry the Stock

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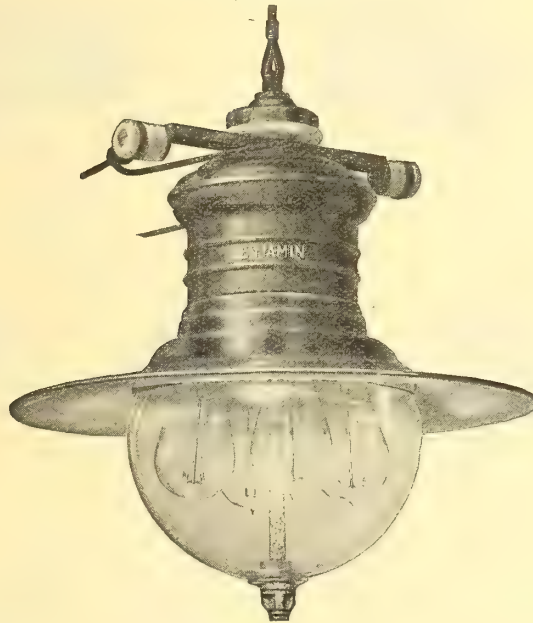
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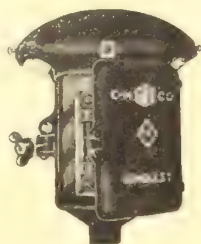
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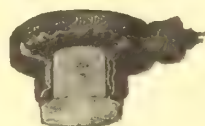


Type E



Type FF

CONDULETS



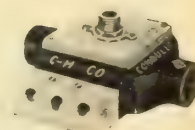
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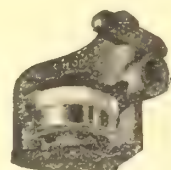
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Type ZD



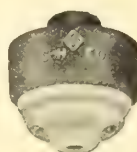
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Type KD



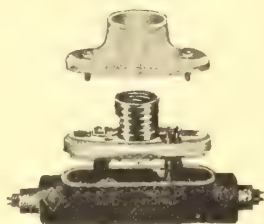
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Type C

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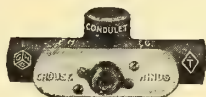
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Toronto, Ont., Canada

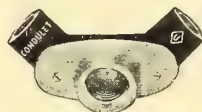




Type L B



Type T

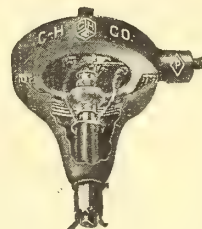


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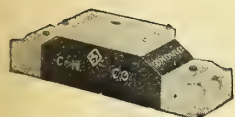


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CONDULETS



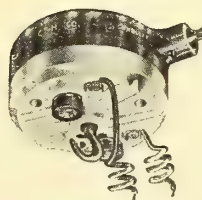
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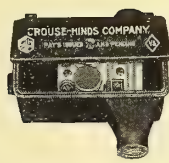
Type R



Type S



Type VC



Type YS



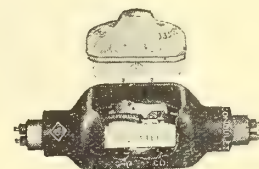
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Bulletin No. 11 Illustrates and Lists our Porcelain Fitting for Condulets and for Molding, Cleat and Temporary Installations. Condulet Pocket Reference is an invaluable book for the man on the job.

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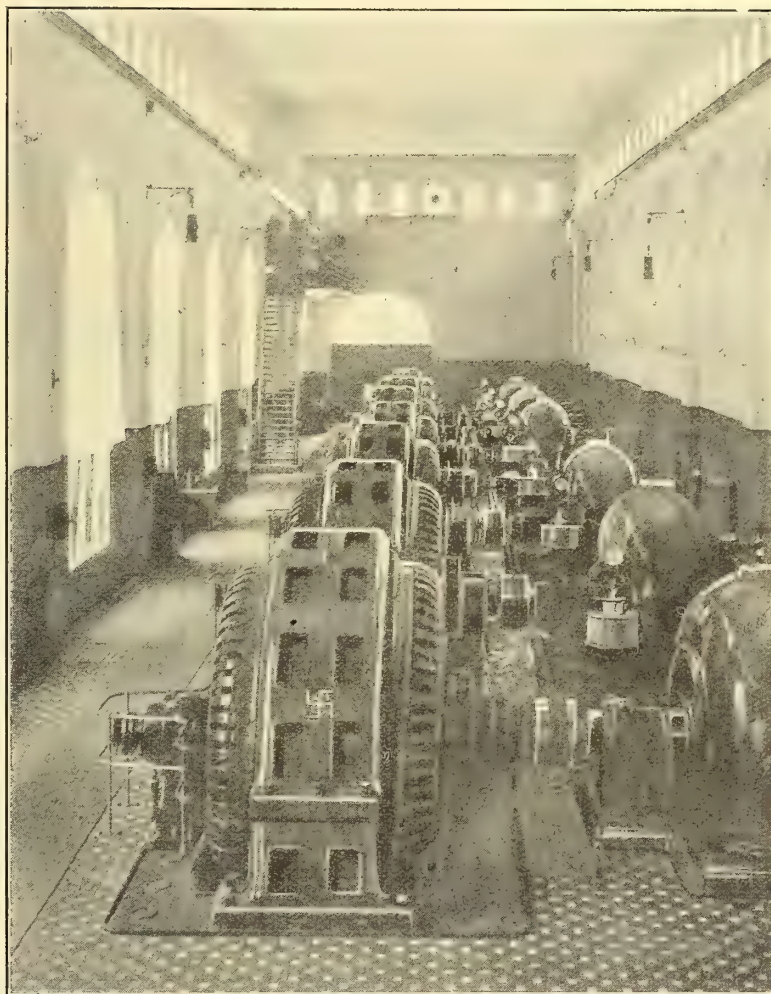
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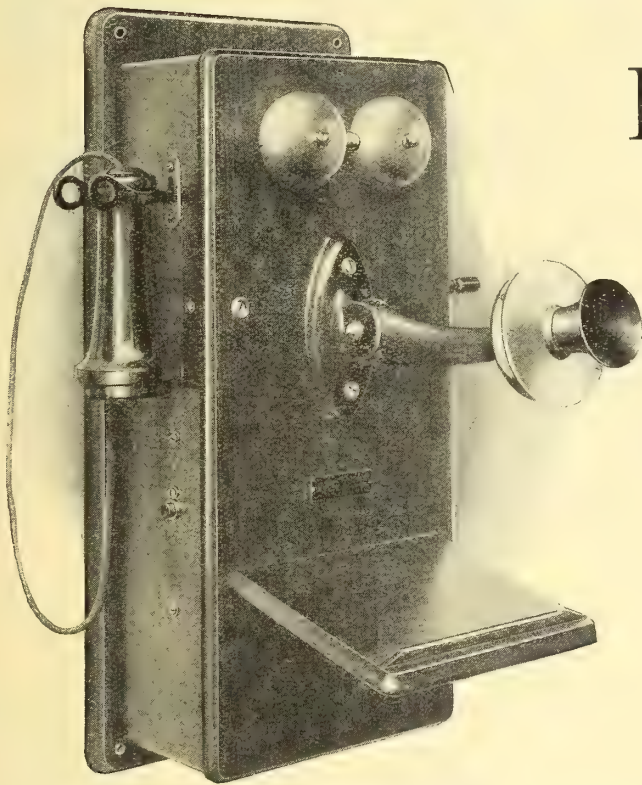
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The Dean Electric Company

Telephone Apparatus

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EQUIPPED with indestructible transmitter and receiver; removable lever hook switch; removable transmitter arm; non-clinging self-contained ringer; powerful generator removable type lightning arresters; Fahenstock battery clips; bushed cord and line wire holes; no circuit portion of apparatus exposed; inside binding posts.

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Made by The Jewel Electrical Instrument Co.

A High Grade Instrument at a Reasonable Price

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The invaluable combination of quality and service is always found in **"GALVADUCT"** and **"LORICATED"** Conduits.

"GALVADUCT" and **"LORICATED"** Conduits are specified in the biggest Architectural and Engineering Enterprises from coast to coast.



New Burns Building, Vancouver
A GALVADUCT BUILDING

The work of installing good Conduits costs no more. Besides they eliminate unexpected and often disastrous mishaps.

"GALVADUCT" and "LORICATED"

conduits give universal satisfaction because they can always be depended on. Quality and durability are their strong features.

"GALVADUCT" has the longest life under service conditions to be found in any conduit. It is zinc coated with an enameled interior, is well protected from corrosion and its raceway is as smooth as glass.

"LORICATED" is a steel tube thoroughly cleaned and coated with flexible enamel. Good protection against corrosion is secured and the thoroughly cleaned and smooth interior makes the insertion of wires easy.

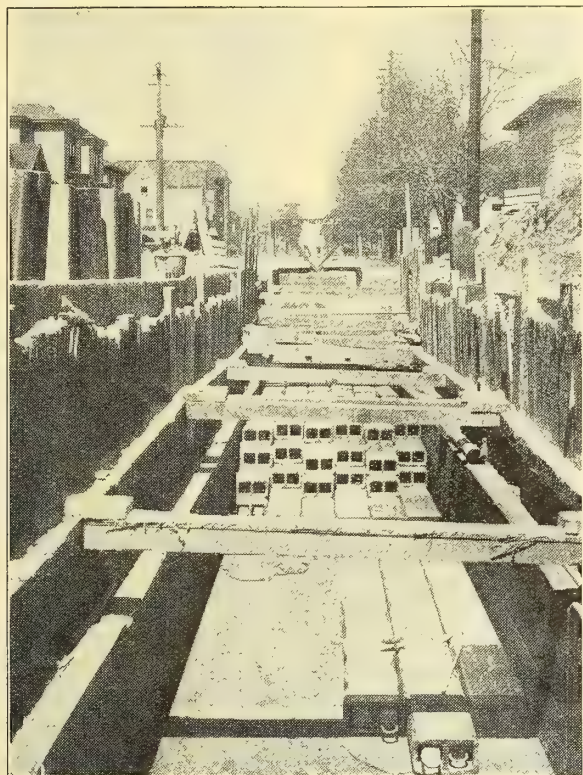
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G. M. GEST

Conduit Engineer
and Contractor



Electrical Underground Conduit Systems

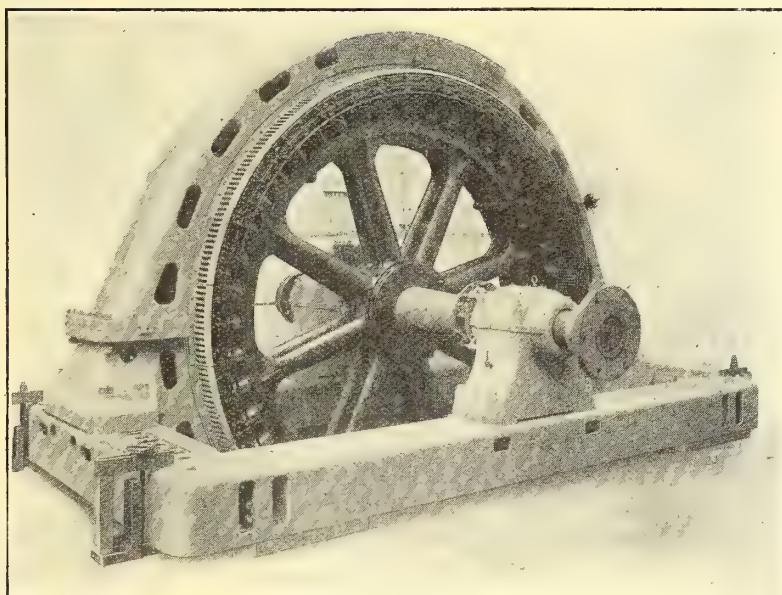
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Generators and
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Currents.

Rotary Convertors,
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Patent Revers-
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Complete
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driving of ma-
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The most efficient reflectors in the world. For Home, Office, Store or Shop Lighting.

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Has the charm of genuine Alabaster—Rich and mellow under light, efficient and decorative—original designs.

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HOLOPHANE D'OLIER REFLECTORS STEEL ALUMINUM ENAMEL and STEEL PORCELAIN ENAMEL.

Made for every demand of the factory and shop from a 25 Watt to 500 Watt size every angle for drop cord—in the Intensive and Extensive bowl types and in the flat domes—with and without socket receptacle.

From Palace to Factory we can meet every requirement in globes and reflectors. Our Engineering department is at your service for laying out your lighting specifications.

THE HOLOPHANE CO., LTD., 60 Front Street West, TORONTO



The Lion M Drawn Filament

The Ideal Lamp for Business Premises

Strong, reliable manufacture, Long Life, More Light all the time. Specially adapted for use in Offices, Stores and Factories.

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Write for special prices and discounts. In lots of 1,000 and over, we etch on each lamp any name or mark required free of charge. Samples submitted for testing.

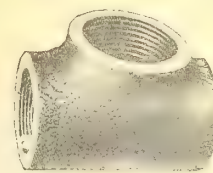
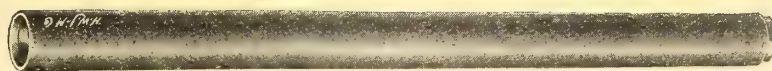
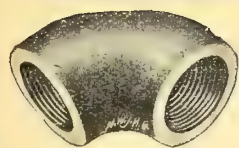
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Installation, freight, excavating, handling, carting, laying, and eliminated cable troubles by installing

J-M FIBRE CONDUIT

"The Strongest Conduit Made"

It is water and acid proof; a positive non-conductor; proof against electrolysis; will resist fire and severe short circuits; is practically indestructible and will last indefinitely.

J-M Fibre Conduit is the kind you will eventually use, but whether now or later, let our engineers help you solve your conduit problems. There is no obligation.

Standard tubes 60 inches long, 2 inches to 4 inches in diameter.

Write our nearest house for descriptive booklet

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**500 Amp. 6,000 Volt Automatic
Oil Circuit Breaker Laminated Con-
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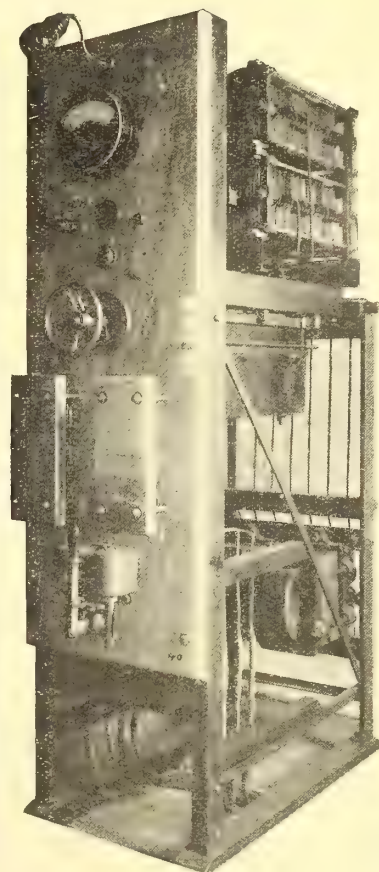
We
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**Electrical
Specialties,
Switchboards,
Switches**

Special Transformers

and numerous other Electrical Ap-
pliances but space prohibits enlarging
on them in this issue.

300 H.P. 2500 VOLT MOTOR STARTING EQUIPMENT





Induction

Long Life Bearings
High Power Factor
Great Overload Capacity
Conservative Rating

The manufacturers of induction motors may be divided into two schools:

Those who prefer the "open slot" construction and those who build under the "closed slot" principle. Each of these contends that their extreme is better than the other. The "open slot" advocates sacrifice electrical qualities to mechanical convenience. The "closed slot" adherents gain the highest electrical advantages, but have a motor which is very inconvenient mechanically.

By means of the special arrangement of the end-rings shown in the illustration, connections of uniform electrical resistance are provided, and all tendency toward local heating or concentration in one ring is avoided.



Motors
Generators
Transformers

Motors

Extra Strong Starting Torque
Unusually Heavy Insulation
Convenience of Repairs
Efficient Ventilation

In the C. W. motor the slots are first made open, allowing plenty of space for the inserting of heavily-insulated form-wound coils, and are then closed by magnetic wedges which give all the electrical advantages of "closed slot" construction. The cut shows how the magnetic wedge "E" increases the distributing area of the tooth and allows the flux to travel a shorter path than is the case where the wood-wedge "P" is used.

For a further discussion of this subject and other interesting advantages of these motors write for induction motor booklet "E."

The C. W. motor has more bars in the rotor than any other similar motor. This results in minimum flux leakage and high torque. This is why it takes a greater overload to stop a C. W. Motor.

Canadian Crocker-Wheeler Co.

Manufacturers and Electrical Engineers

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BRANCH OFFICES: MONTREAL, QUE.
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W. T. GLOVER & CO., LTD.

ELECTRIC WIRE & CABLE MAKERS

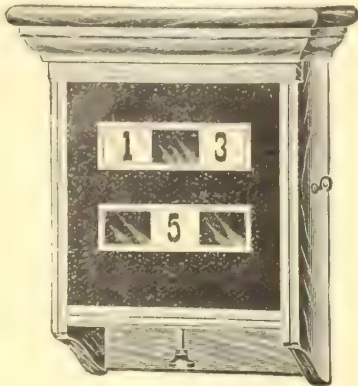


“
GLOVERS DRUM MAJOR.
”

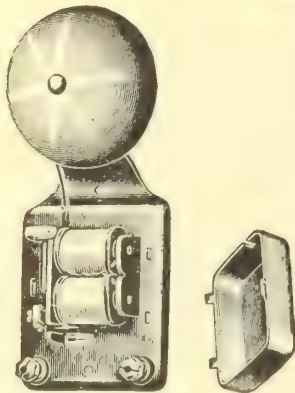
CANADIAN HOUSE:
207 Lumsden Building, Yonge St., TORONTO, ONT.

HEAD OFFICE AND WORKS:
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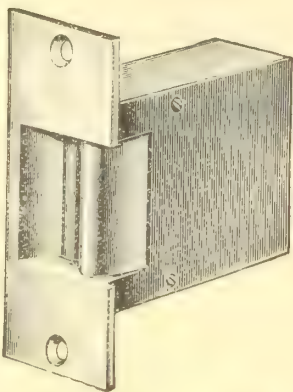
Electrical House Goods of Edwards Quality



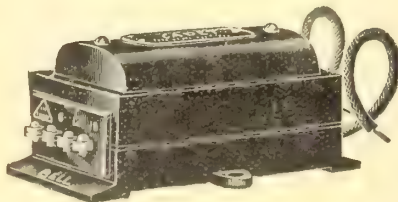
Annunciators—The general characteristics of Edwards Annunciators include scientific design throughout, compactness, durability and excellence of finish. The drops used are of the gravity type, and are such as to avoid the faults of many types of annunciators, that is to say, accidental indications, insufficient clearness in indication, loss of magnetism and change in polarity.



Edwards Iron Box Bells represent a radical departure in the iron box types, and may be said to be the only advance in iron box construction within recent years. We claim for them the highest possible degree of perfection in design and manufacture. They are rustproof, bugproof, easily installed and easily adjusted.



Electric Door Openers and Latches—The Edwards line of electric door openers and latches will be found most reliable and complete. They have been made as compact as possible, consistent with rugged construction, in order that they might be available for use under most varying conditions and installed at minimum expense.



Transformers—Every precaution has been taken to make Edwards Transformers reliable and practicable. There are no moving parts; the windings and laminated core of highly efficient non-aging steel, are entirely enclosed. They are made in two types, viz., the Dixie and the Cadet. The former is made for one secondary voltage only, while the latter is made with connections for 6, 12 and 18 volts secondary.

Other Edwards Specialties Include Burglar and Fire Alarm Apparatus, Pushes and Sundries, Special Signalling Devices, Door Switches, Etc.

Write To-day for Complete Catalogue No. 2036 on Edwards Electrical House Goods



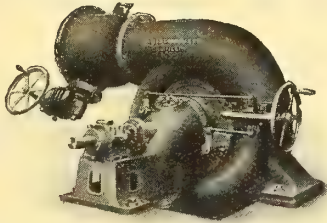
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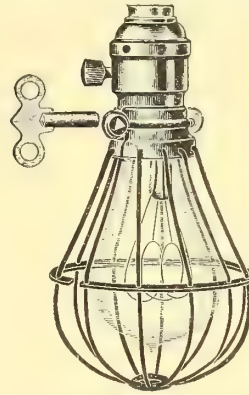
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BECAUSE—It has more points of merit and advantage than any guard made at anything like its price.

BECAUSE—It assures Complete Protection for Lamps and Complete Satisfaction for the User.



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LAMP GUARD
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Carried by leading Canadian Electrical Houses.

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Talk No. 2

THE MAINER ELECTRIC COMPANY LIMITED have moved into their permanent premises at 61 Albert Street, a fine roomy, down-town store within two hundred yards of the Post Office. We consider it a modest beginning, but we want room to grow up. It always feels better to take a little time to grow, "Doubtless you know the fable of the boy who grew too tall for his age, so that he wobbled at the knees."

Everyone in the trade seems to think there is room for another independent electrical supply house in the Western Provinces, and we are aiming at completely filling this void. What with a brand new stock, an enthusiastic staff, and a fresh-paint smile, there should be no doubt about it.

We are on the look-out for new ideas in the electrical selling game. If any factory feels that they are not getting their share of the business, better drop us a line and suggest a few of your strongest selling features. Perhaps we can help you out. We sell all standard electrical supplies.

The Mainer Electric Company, Limited

61 Albert Street, WINNIPEG, MANITOBA

A WINTER NIGHT

*"When biting Boreas, fell and doure,
Sharp shivers through the leafless bower;
When Phoebus gi'es a short-lived glower
Far South the lift,
Dim darkening through the flaky shower,
Or whirling drift:"*

Burns.

Then comes with a rush the demand on Central Stations for more light. It is well for them to foresee and prepare for this demand by increasing their stock of transformers early in the Autumn. All our transformers have been carefully designed to meet the requirements of modern central station practice.



With the increasing use of induction motors on central station circuits, it is essential that transformers be interchangeable for either lighting or small motor service. The majority of induction motors operate on a power factor varying from 50 to 90 per cent. depending on the load carried. The load capacity drops with the square of the fall in voltage of the current supplied to them. For example, a motor which at 220 volts has a capacity of 25 h. p. will at 200 volts have a capacity of only 20 h. p. A transformer may easily cause this drop

in voltage if the design is poor. This shows the importance of proper regulation. We guarantee the regulation of our standard transformers to be so good that both lights and motors may be operated from the same set of secondaries with perfectly satisfactory results. This means that instead of keeping two types of transformers as formerly, one for lights and the other for motors, the central station need carry only one type in stock.

ALLIS-CHALMERS-BULLOCK LIMITED

Works: Montreal. Sales Offices: Montreal, Cobalt, Toronto, Winnipeg, Calgary, Vancouver.

The New Hubbel Plug "Fifty-8-Fifteen"



**The Smallest Separable Plug
for the Biggest Service**

NO Plug near its size can do so much. No Plug twice its size can do any more.

Measures $1\frac{1}{4}$ inches from base end to cap top. Cap extends about $\frac{1}{2}$ inch from lamp socket.

Contacts embedded in a one-piece porcelain base. No live parts are exposed when connecting or disconnecting.

Cap made of non-breakable composition. Contact blades have rounded ends and notched edges, which are gripped by stiff springs in the base.

Cap and base go together with a click, hold securely never stick. Push-in cap prevents twisting of the cord when making connection.

You must see and test "Fifty-8-Fifteen" to know how much goodness can be packed in a small plug. If you wish a Sample Free, write today. Use your business letter-head.

R. E. T. PRINGLE

TORONTO MONTREAL WINDSOR

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**Street Railway Material
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**Fibre, Pressboard, Leatheroid,
Insulating Material, "Hot
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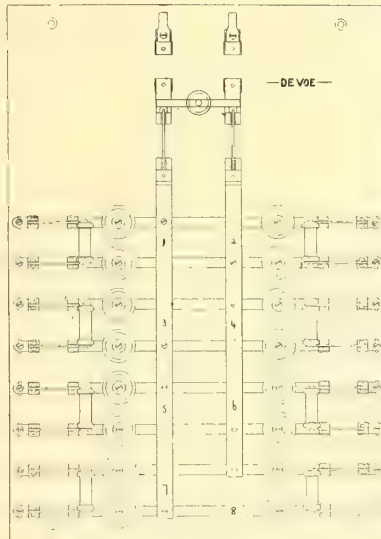
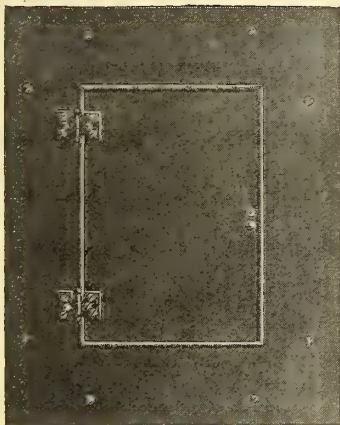
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desiring to finance their needs by the sale of Bonds are requested to communicate with us.

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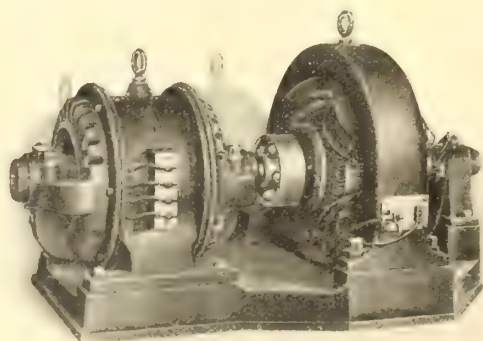
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Established 1882
Incorporated 1911

35 Federal Street, Boston, U.S.A.

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Make Motors for all Circuits
Dynamos for Power and Light
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Repairs executed neatly and promptly
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A few of our specialties :

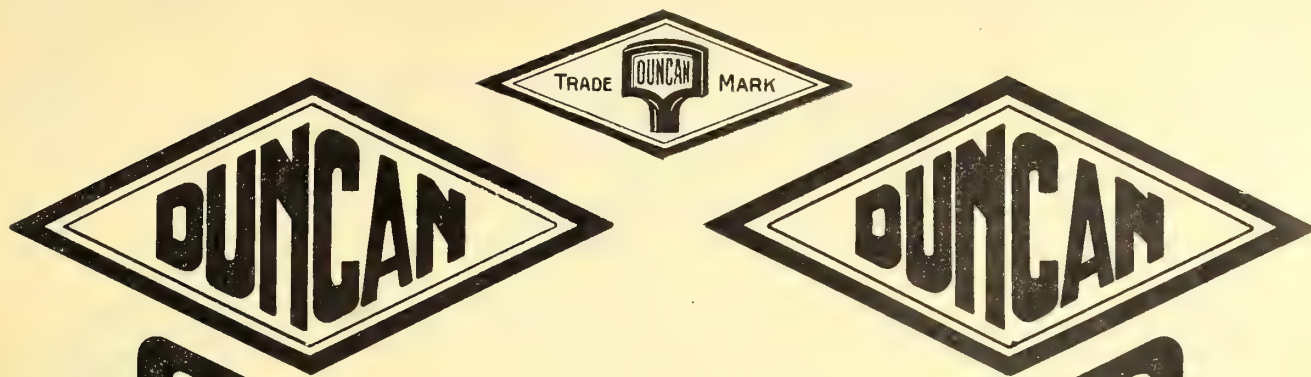
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Large stock ; prompt shipments.

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36 Adelaide St. West, Toronto



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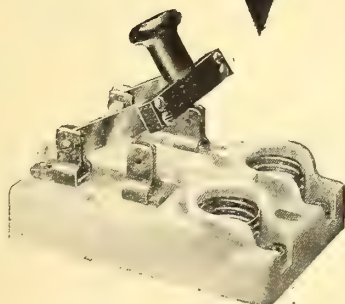
are the two prime reasons
which we emphasize as to
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with our supplies.

Our reputation has been built
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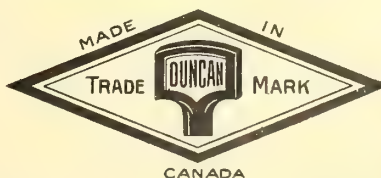
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The
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Makers of Electrical Supplies
bearing this trade mark.



No. 1695 (¼ Full Size)



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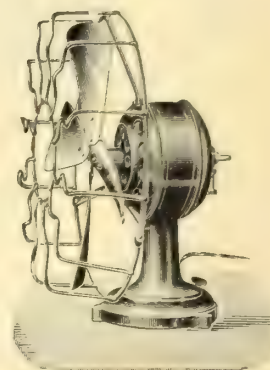
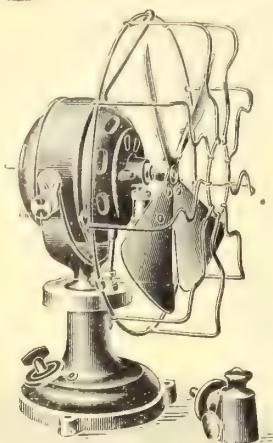


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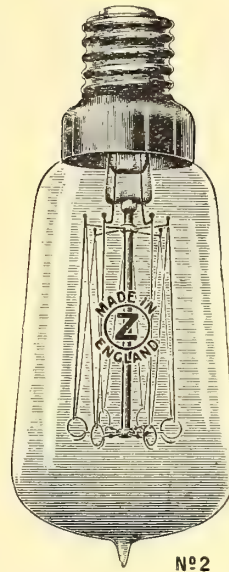
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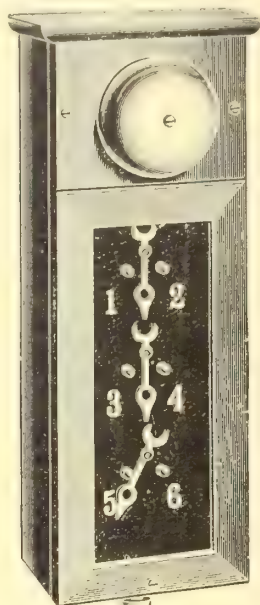
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The plant which operates non-condensing may have 10 per cent. heat efficiency and the condensing plant a possible 14 per cent. conversion.

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You can get a price for it which will pay the total fuel bill of the plant, including also such other expenses as water, oil, etc.

CAN IT BE DONE? YES!

Others are not only doing that very thing, but are also earning interest and depreciation on the cost of the steam installation.

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but Solicit Business and Manage Such Plants, if Required.*

Why Not Take Advantage of Our Experience?

Central Station Heating & Construction Co.

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**Drawn Wire "MAZDA" Lamp is
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Chemically pure Tungsten metal actually drawn in the form of Wire composes the Filament of **Sunbeam Drawn Wire "MAZDA" Lamps** making them as rugged as the present Carbon Lamp.

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Imitated but Never Equalled

The Label is the Guarantee of **QUALITY**

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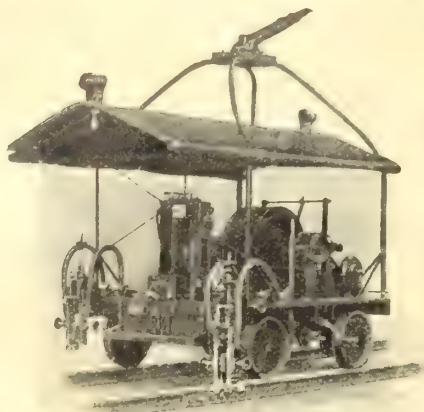
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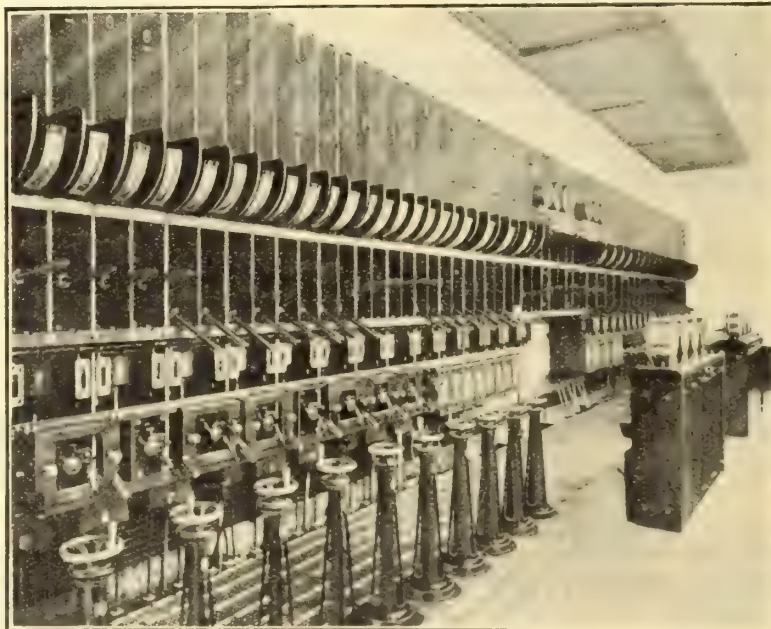
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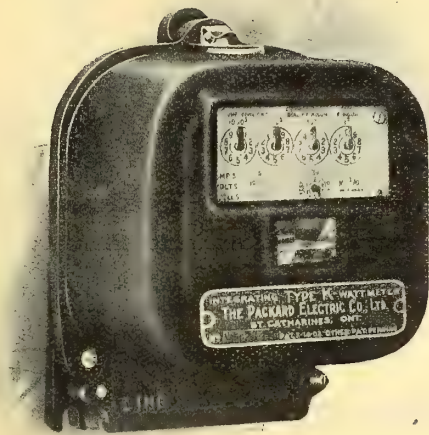
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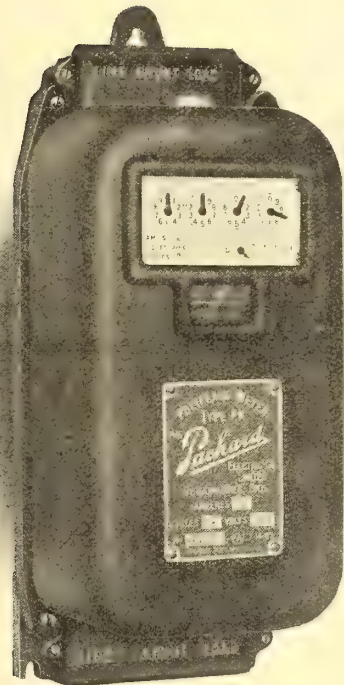
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Copper Trolley Wire
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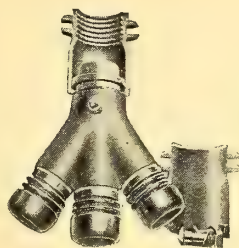
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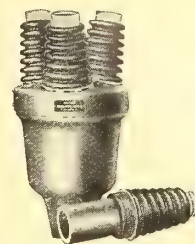
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Macdonald, Marpole Co. Limited, VANCOUVER



Our Patents Protect You

as well as ourselves against imitations, which are always inferior to the genuine.

We own Canadian Patents Nos. 131345, 131346, 131624 and 131625 which cover the distinctive features which put

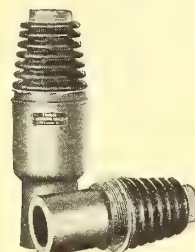


Standard D.O.A. Cable Terminals D.S.

in a class by themselves as regards durability and economy.

Our prices are no higher because of this exclusive quality but are as low as products of equal quality can be successfully sold. Compare them and see!

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Department E

Hamilton, Ont.

Manufacturers of Electric Wires and Cables of all kinds, all sizes, for all purposes; also Cable Accessories.

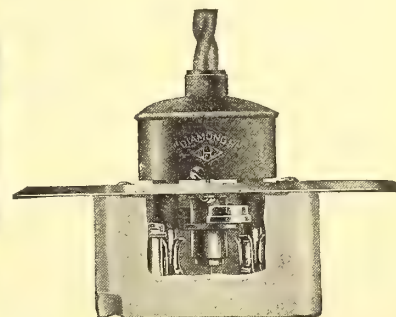
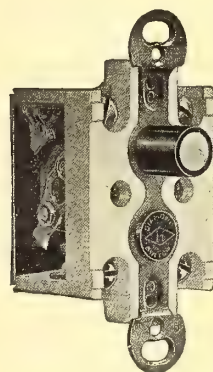
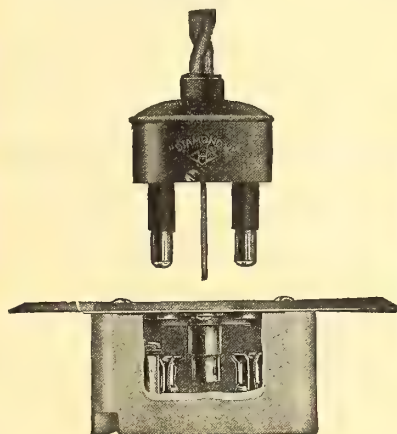
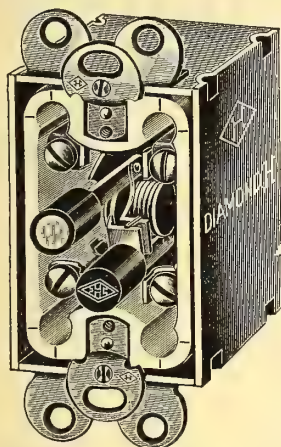


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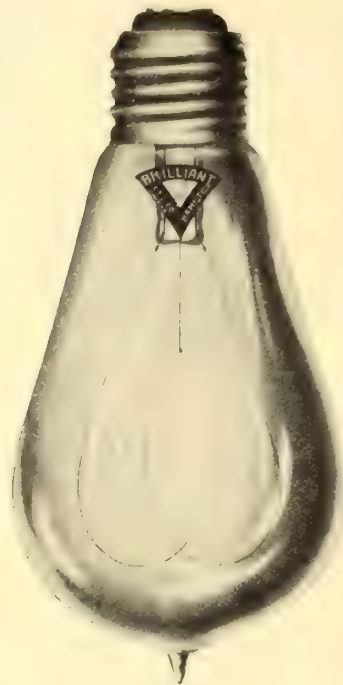


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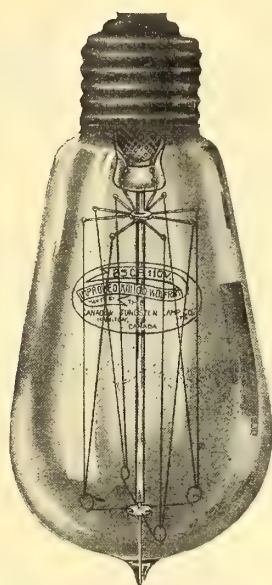
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New Brunswick—St. John, T. McAvity & Sons. Victoria, B. C.—911 Government St.
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The Canadian Tungsten Lamp Company

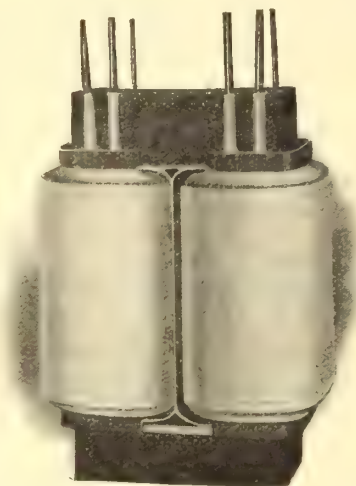
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HAMILTON - - - ONTARIO

Transformer Investment



Type H. E. Oil-Cooled Transformer Front View showing lead wires and general appearance



Interior view Type H. E. Transformer Coil and Core. Note small parts.

The Transformer installation in any power line is an investment which can be held at a loss—and very often is—and it can be made pay direct profits.

This depends on the efficiency of the apparatus—the extent of the Core and Copper loss, the consumption of energy in the transformation of current, maintenance cost and length of life.

Moloney High Efficiency Transformers

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They are made to convert current with the lowest possible Core loss—made to do that continually, day and night for a period far in excess of any other Transformer.

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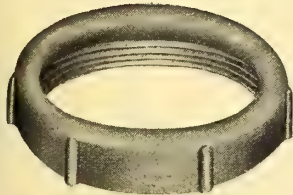
COMPLETE STOCKS:

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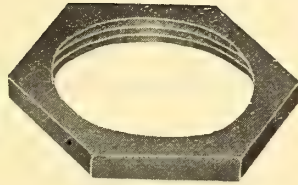
WINNIPEG

VANCOUVER

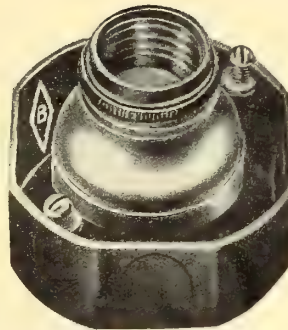
Electrical Supplies



1 1/4" Bushing



1 1/4" Locknut



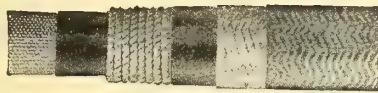
No. 6350—Box and Receptacle



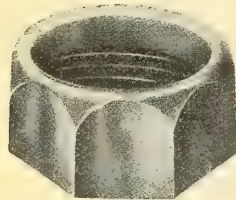
No. 1915—Box and No. 3719—Cover



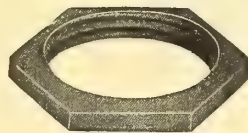
1455—Reversible Guard



Alphaduct



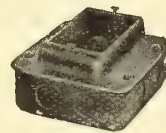
1/2" Bushing



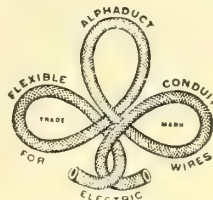
1/2" Locknut



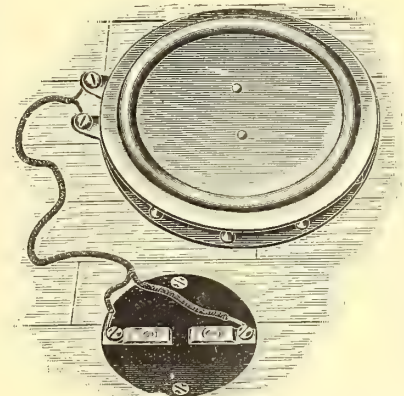
1/2 to 1" Grounding Clamp

81 A
Fixture, Stem

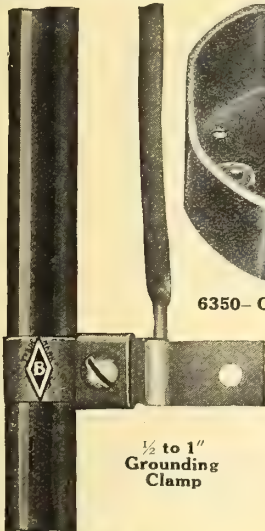
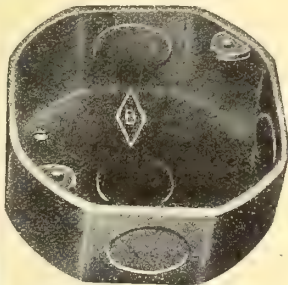
No. 1915—Switch Box



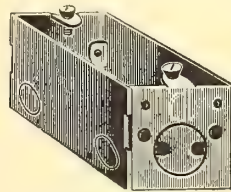
Alphaduct 1/4"



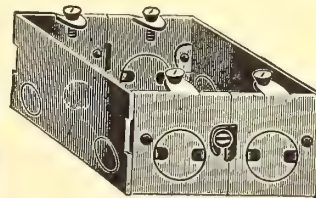
1150—Floor Tread

1/2 to 1"
Grounding
Clamp

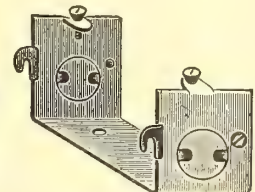
6350—Outlet or Junction Box



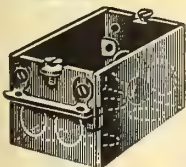
170—Comb Switch Box



172—2 Gang



171—Spacer



C C S. I. Switch Box

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British Columbia Agents, Cope & Son Ltd., 132 Water St., Vancouver, B. C.

"Made in Canada"

Write for Catalogue No. 3. If your Jobber cannot supply, write us.

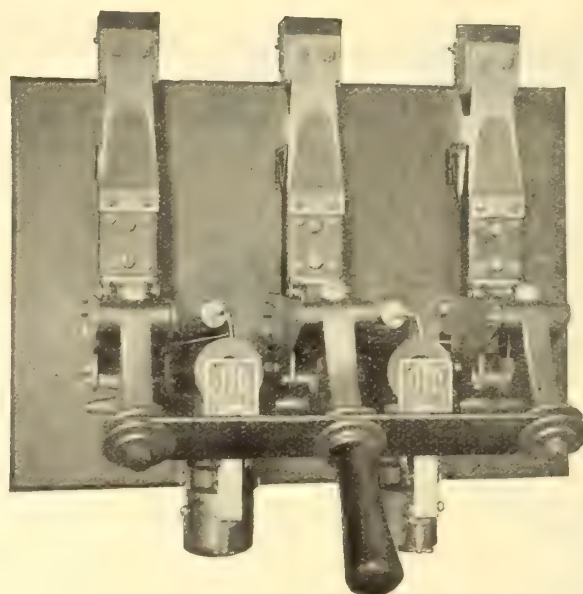


The Induction Motor



is a sturdy piece of apparatus, but staunch though it is there are many exigencies of service from which it should be given such protection as can best be secured by the use of a properly chosen

I-T-E Circuit Breaker



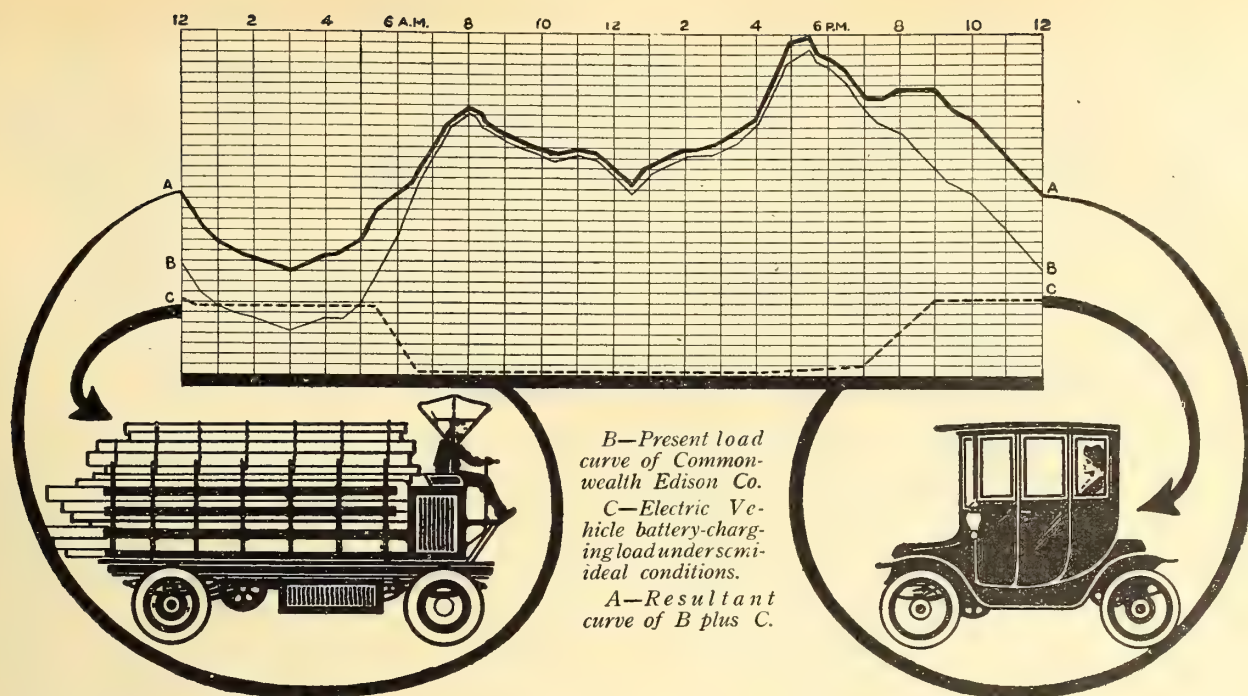
The Type "W," three pole, Time Limit (DALITE) Circuit Breaker shown herewith is admirably adapted to the protection of induction motors operating under a wide variety of conditions. This form, together with others covering practically the entire range of industrial service, is described in our new

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Eccles & Smith Co., 524 S. Los Angeles St., Los Angeles, Cal.
Eccles & Smith Co., 68 First Street, Portland, Ore.
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I-T-E Electric Co., 72 Finsbury Pavement E.C., London, Eng.





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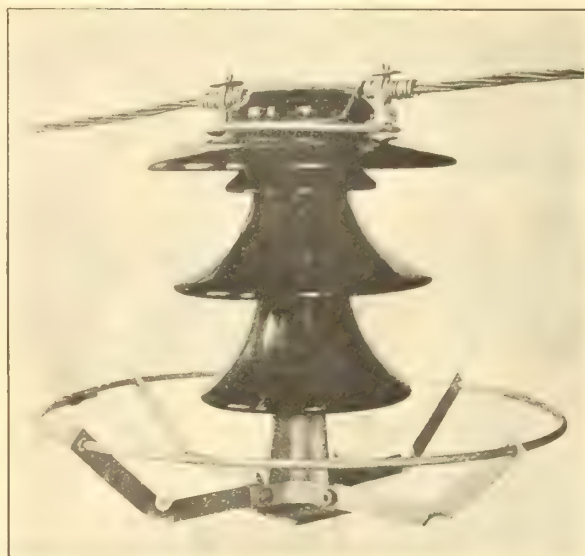
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ELECTRIC VEHICLE ASSOCIATION OF AMERICA
 BOSTON NEW YORK: 124 W. 42nd St. CHICAGO

[14]

Nicholson Arcing Rings



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August 9, 1910

These rings save repairs, save time, conserve the good-will of your customers and compared with the benefits, the cost is trivial.

If you are willing to spend say \$10,000 for lightning arresters at your stations, consider the consummate wisdom of protecting (at a cost of say \$2000.00) your \$10,000.00 worth of lightning arresters, your apparatus *and* your line!

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OR

Engineering Equipment & Supply Co.

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Engineering Works of Canada, Limited

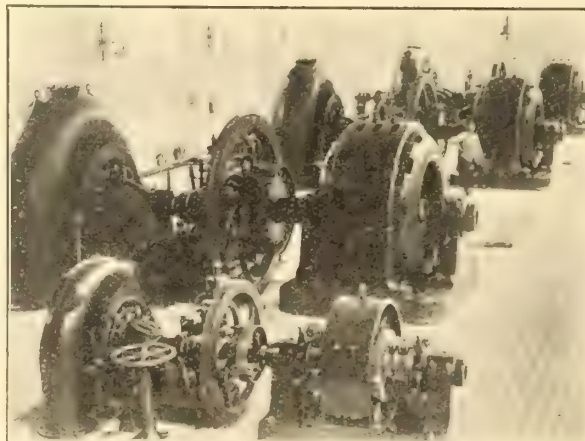
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It pictures many prominent interiors most beautifully lighted by the EYE COMFORT SYSTEM.

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(REVERSIBLE)



24 inch handle only

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On a Construction Tool

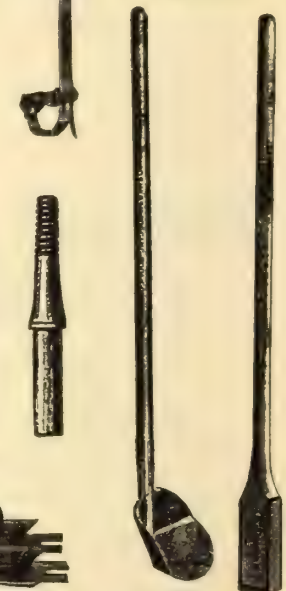
is the guarantee of the highest perfection that modern facilities attain in the manufacture of

Linemen's Tools

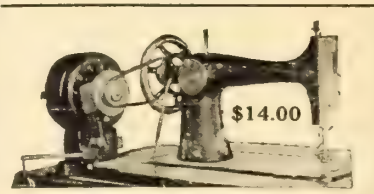
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Oshkosh Mfg. Co.

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\$14.00

pressure of the foot on the treadle. The simplest, the most durable, the cheapest to operate and last but not least, the cheapest in price.

Write for particulars and net prices.

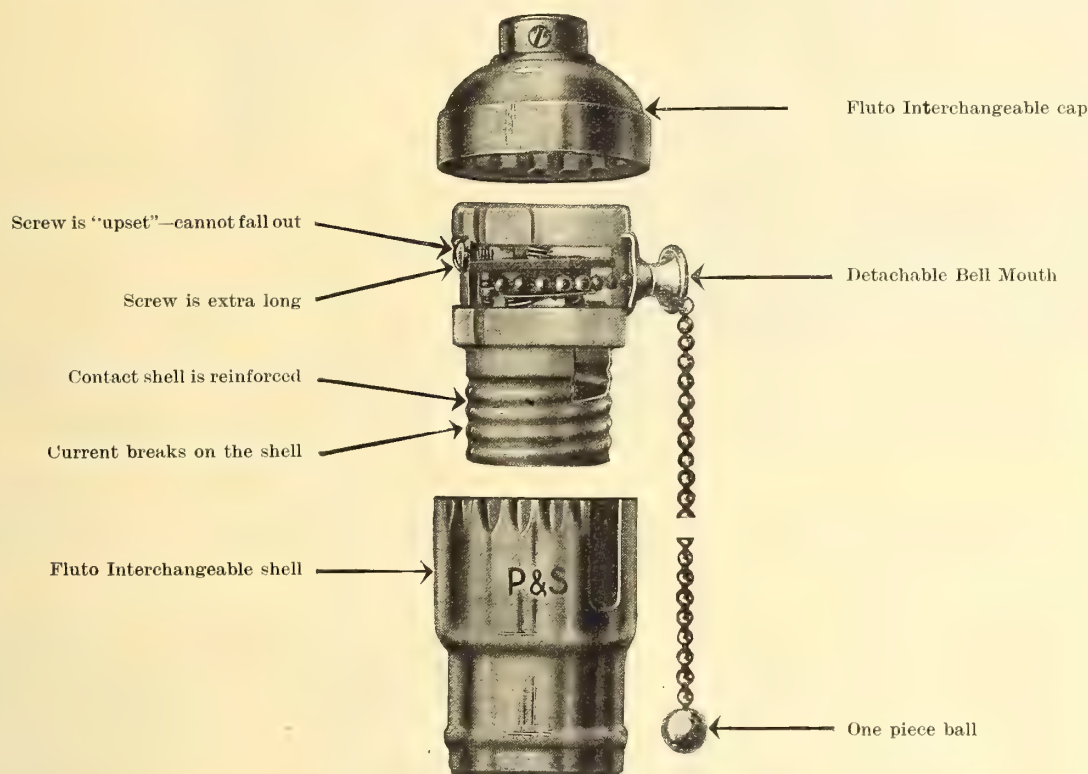
Fidelity Electric Company, Lancaster, Pa., U. S. A.

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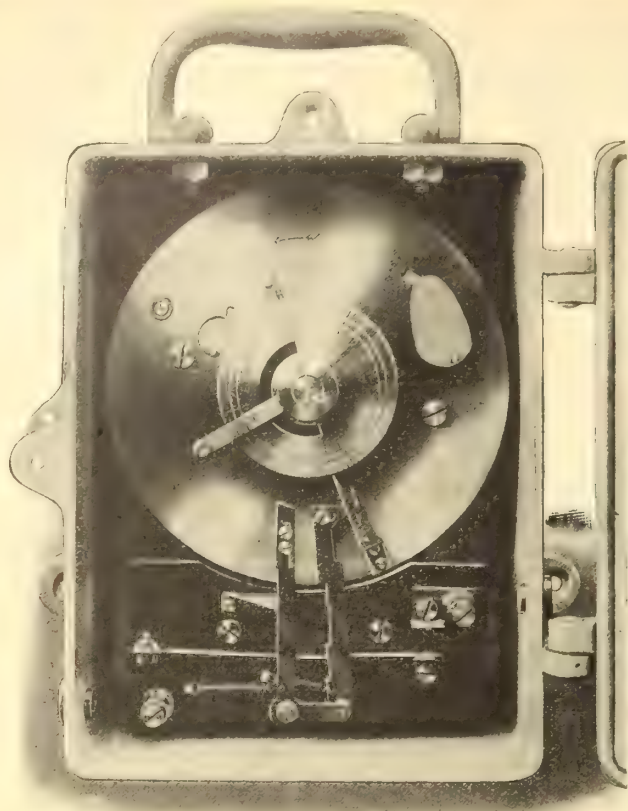
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"Venner" Time Switches

For Controlling

Two-Rate Meters

Street Lighting

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Various Types. Send for Lists.

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Sundh Sump and Tank Switches are the Simplest and Strongest

Unequalled for controlling water levels in tanks, wells or sumps.

Absolutely weather proof and will perform their duty with reliability.

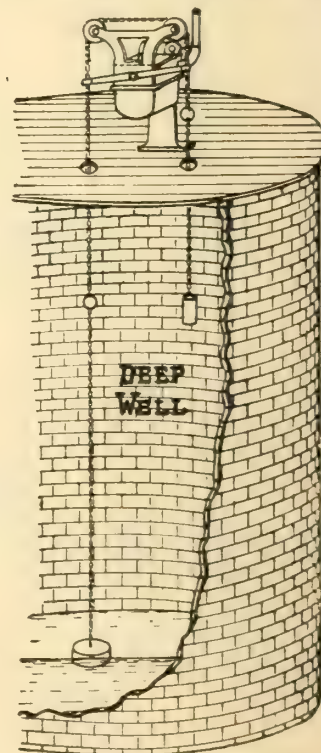
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"Sundh" Switches, Panels and complete line of Controlling Devices described in our catalogue.

Send for one to-day.

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NEW YORK, U. S. A.

Represented by the C. H. L. KEELER CO. of TORONTO, CANADA



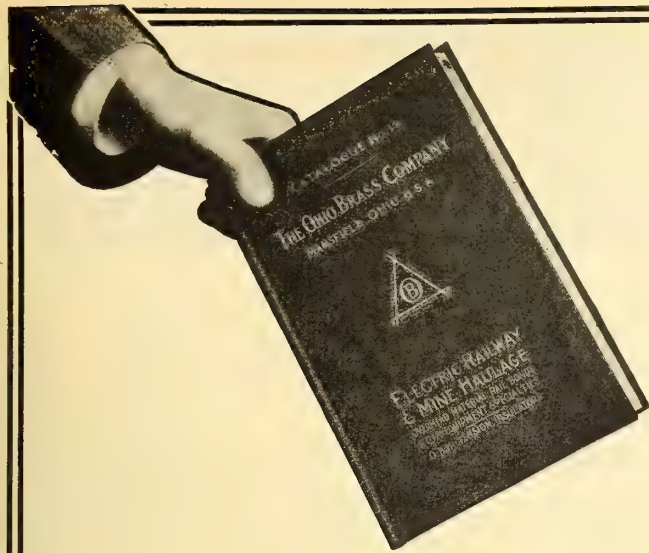


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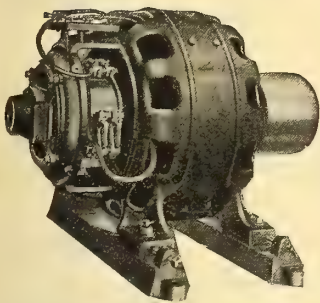
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Holtzer Cabot Motors

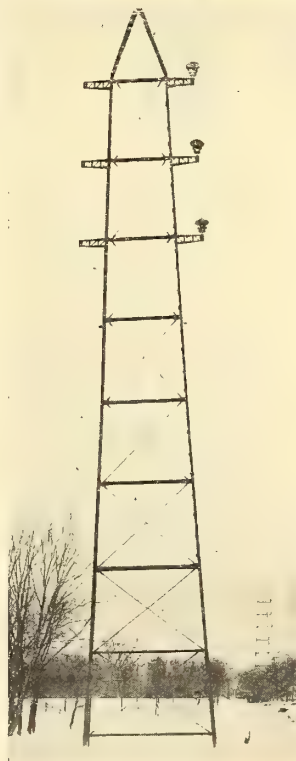
Many Types for Many Purposes

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" 304	—	" "ST"	Single Phase Motors
" 306	—	" "M"	Plating Dynamos
" 314	—	" "C"	Direct Current Motors and Dynamos
" 316	—	" "LM"	Direct Current Motors
" 317	—	" "K"	Direct Current Motors
" 318	—	" "CL"	Slow Speed Motors D.C.
" 320	—	" "QP"	Polyphase Motors
" 329	—	" "AL"	Slow Speed "AC" and "DC" Motors
" 330	—	" "QS"	Single Phase Motors
" 331	—	" "QD"	Direct Current Motors
" 333	—	" "QPW"	Variable Speed Polyphase Motors
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THE HOLTZER-CABOT ELECTRIC CO.
BOSTON - CHICAGO

Steel Transmission Structures



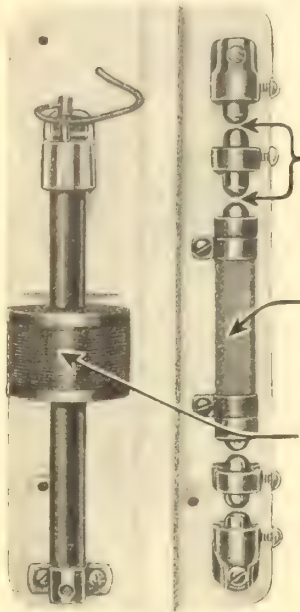
□ The cut shows the type of flexible "A" frames recently erected for a 34 mile line from St. Catharines to Hamilton. These are 47 feet high and 9 feet wide at the ground. Placed approximately 400 feet apart along the line.

This line has worked out at a cost very little in excess of a wooden pole line. If you have a new transmission line to build or a wooden pole line to rebuild, write us.

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Small Air-Gaps
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Low Voltages,
Winking Lights

The Circuit-
Breaker Elimin-
ates Grounds
and Short
Circuits

Do you realize that you are right now in the midst of the lightning season? Is all your electrical apparatus thoroughly protected? Remember that one flash can do enough damage in a fraction of a second to cost you more than an entire equipment of

Garton-Daniels Lightning Arresters

Study the illustration. It shows just why you get complete lightning protection from these arresters—the only arresters combining small air gap distance, low series resistance and a circuit breaker.

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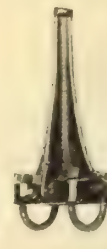
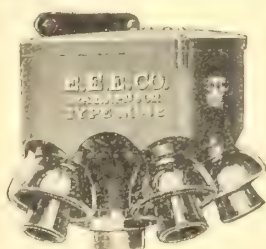
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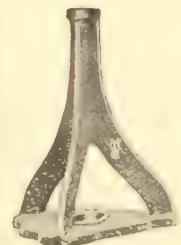
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Electrical News

Generation, Transmission and Application of Electricity

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No. 9

Good Method of Regulating Wages

Some months ago, the Philadelphia Rapid Transit Company adopted a new method of payment for its conductors and motormen, which consisted in setting aside 22 per cent. of the gross receipts from passenger transportation as a wage fund from which the men were paid. At the time this scheme was introduced, the men averaged 23c per hour, but by the end of the year, the gross receipts had increased to such an extent that the men were averaging 25c per hour, a gain of approximately 10 per cent.

Information is not available as to the cause of increase in passenger receipts, but it can easily be believed that such an increase would be due to this admirable system of making the men, in a sense, co-partners in the business. The scheme would appear to have much to commend it to the average railway company. Much of the success of a railway system depends on its conductors and motormen, and the attitude of the public in large measure is regulated by the attitude of the railway employees. We are all aware of the amount of trouble a disgruntled conductor or motorman can cause on a crowded street car. He really controls to a large extent the attitude of the public towards his company and if by any scheme of payment the employees can be made more vigilant, more loyal, more active to remedy little defects, such a scheme would seem to be the proper one to pursue. It is a characteristic that motormen and conductors possess in common with the rest of us that where we are personally interested, we are able, in spite of ourselves, to give better service, and where it would mean an increase in wage, the conductor could be depended upon to stop and pick up all the passengers, to be courteous, to be alert and honest in collecting fares, and above all,

he would make a point of presenting his company and its various operations in the best possible light before the public. Much of the trouble between railway companies and their patrons is imaginary, born of the belief on the part of the patron that the system is badly managed and the employees unfairly treated. Both of these matters the employees have it in their hands to remedy, if the proper spirit of co-operation exists.

Power in Uxbridge District

The citizens of Uxbridge and the surrounding neighborhood are enthusiastic over the prospect of power at \$45 to \$55 per horse power year, or thereabouts—with presumably the twenty minute peak clause attached. Really, it does seem an injustice that the credit of the whole province should be involved in giving these little towns cheap power—and especially in view of the fact that the said town of Uxbridge can, if it care to go to the expense, install a steam or gas plant to generate power twenty-five per cent. cheaper than the rate quoted by the Commission. As a matter of fact, energy is being sold in these towns at a correspondingly lower rate than that right now, though in many cases there is not sufficient demand for day power to justify twenty-four hour service. The experience of Kingston should not be forgotten, nor the report that advised the installation of steam equipment in preference to a \$25 h.p. rate. An overestimate of the value of Niagara power as a panacea for all the ills of high living costs and an unreasonably animosity towards private operating companies bids fair to lead a number of these towns into unprofitable contracts. Niagara power for Port Dalhousie is one matter, but Niagara or Severn River power for Uxbridge or Port Perry is quite another, and it would seem only justice that the Commission should recognize and openly admit the limit of its possibilities.

Electricity on the Farm

The Hydro-electric Commission is engaged in the altogether praiseworthy effort of popularizing the use of electricity among the farming communities of Ontario. It is a worthy cause from the farmers' view point because, first, as a class they have comparatively few of this world's so-called luxuries, and second, it will be an added incentive to attack all their problems in a more scientific manner. From the town man's point of view it will mean, doubtless, a gradual slackening in the rush from the farm to the city and possibly a reduction in the cost of living as a result of this solution of the present helpless condition of labor shortage. A most hopeful factor, which doubtless the Commission is not overlooking, is the high order of intelligence and adaptability almost invariably possessed by farmers' sons which will make strongly for the successful operation of the equipment when the installations are once made.

It might not be inopportune, however, to sound a note of warning against what looks like a tendency to paint the possibilities in too glowing colors. A politician can rarely resist the temptation to enthuse his hearers and electricity is an intensely interesting subject—rendered all the more so by reason of its mysteriousness. If one may judge by the press reports of the Commission's recent utterances, two horse power will plough the land, sow the seed, reap the harvest, thresh the grain and at the same time attend to all the little minor incidentals of pumping water, crushing grain, milking the cows, churning, etc., etc.—with ample power to spare. No doubt many Ontario farmers are already worried at the very thought of the idle lives they will be forced to lead in the near future—all as the result of the installation of 2 horse power of Niagara "juice."

We do not know if the Hon. Adam Beck is a practical

... farmer. He has a right to know the intentions of the electric reports and should hasten to correct them. If he is not he should become well acquainted with the facts so that he may not make any misleading statements. The facts show that the most ordinary operations of pumping, sawing wood, chopping grain, etc., requires up to 8 or 10 h.p. Threshing not less than 20-25; ploughing—much more. Then there is the cost of all the equipment—transformers and a variety of motors, most of which must be mounted on trucks to be of most general use, which adds considerably to the original cost. To be efficient this equipment must also be good, which means that it will pay in the long run to buy the most expensive apparatus. Have the farmers been told in any specific instance what it will cost to purchase, maintain and operate such equipment? This would seem to be the proper basis to start figuring from if the advantage of the farmer is really the ultimate aim. Unfortunately this side of the question does not so readily arouse enthusiasm.

In one case, indeed, a figure does seem to have been suggested—in co-operative threshing. It is reported that (about) \$1,200 would purchase a portable outfit which would be sufficiently powerful for this work. It is suggested that this equipment be purchased by a number of farmers on the co-operative plan. Did the speaker know that a steam engine costs only half this much and that instead of consuming \$10 to \$20 of electric energy per day it is fired with old rails, pine roots, etc., at a minimum of expense? In the case of the steam engine, too, the co-operative system has not worked out, so is it not even less likely to do so when the expense involved is doubled.

For a start it would seem to be the part of wisdom to confine the exploitation of electricity on the farms to the more simple operations—electric lighting and household appliances, grain crushing, possibly milking. The use of a portable storage battery to be charged over night and available for traction or other purposes during peak load hours might come next, but is too expensive for most, as yet. No doubt the others will come with increased experience and reduced cost of energy and equipment, but to the electrical man who also remembers from his early experiences the problems of the farmer, any misleading statements or unjustifiable enthusiasm appear in the light of bad judgment and bad taste, not to be condoned by any political advantages to be gained.

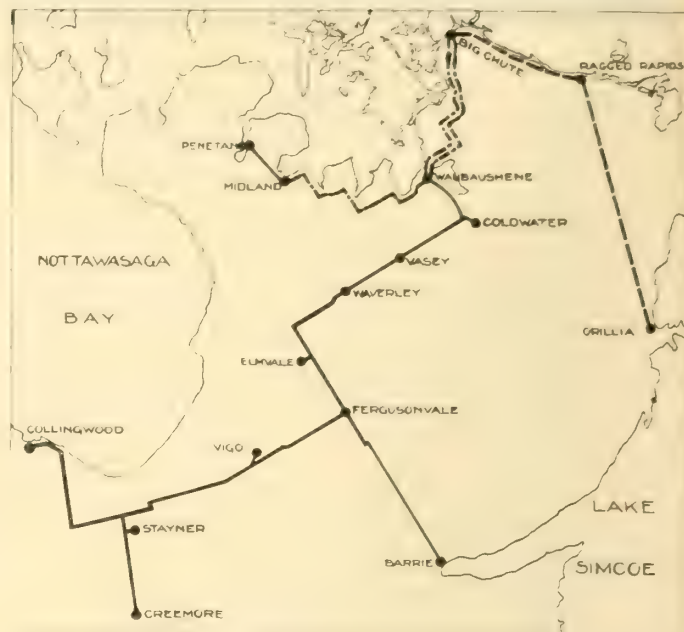
Hydro-electric Extensions

Work is well under way on the distribution system which will serve the Barrie and Collingwood section. A sketch map showing the course to be followed by the distribution lines is shown herewith. Contracts have already been awarded for the equipment required in the various sub-stations, which will be supplied by the Canadian General Electric Company with the exception of the lightning protection equipment, which is being supplied by Siemens Bros. This will be the same lightning equipment as supplied by this firm for Port Arthur and a number of Western Ontario points, and which has given the Commission excellent service.

The map indicates also the location of the power plant of the Simcoe Railway & Power Company on the Severn River at the Big Chute, where the power will be obtained. There is also shown the transmission line which serves Orillia connecting first with Orillia's own power house at Ragged Rapids. This line from the Big Chute to Orillia is owned by the town of Orillia. The map also shows a double transmission line connecting the power plant with Waukegan which is owned by the Simcoe Railway & Power Company, as is also the line connecting Waukegan with Midland; the duplicate line shown is now under construction.

From Midland to Penetang the line is being built by the Commission, as are all the other lines shown in this map in heavy unbroken line.

The Commission also has under construction at the present time twenty-two miles of line connecting Morrisburg with Prescott, which also is being built for 25,000 volt service. Power will be obtained at Morrisburg, where a contract has been closed with a private company to supply 800



h.p., enough, it is believed, to supply Prescott and the immediate vicinity for some time to come.

The growth of the hydro-electric system in Western Ontario is seen by the necessity for extensions to equipment in a number of the sub-stations. At Niagara Falls, in the stepping-up station, 15,000 kw. of Westinghouse transformer equipment is being added. In Dundas the 3,000 kw. originally installed for distribution locally and in Hamilton is being increased to 10,000 kw., and in Toronto the capacity is being doubled to 20,000 kw. In the two latter stations C. G. E. equipment is being installed.

The 1911 Year Book

The Census and Statistics Department, Ottawa, have issued their year book for 1911, containing, among other interesting matter, information about electric railways, telegraph, telephone, hydro-electric, and electric light operations throughout Canada.

The total number of miles of electric railway operated, as reported on June 30th, 1911, was 1,224. The total capital expended, \$111,532,347. Earnings for the same period total \$20,356,954, and operating expenses \$12,096,134, leaving net earnings of \$8,260,817, or at the average rate of approximately 7.3 per cent. on capital invested. The number of miles added during the year ending June 30th, 1911, was 175.

The total number of electric light companies operating in 1911 is given as 418, of which 228 are in Ontario. The number of lamps used is 23,530 arcs and 3,736,160 incandescents.

The amount of electrical energy produced for export and for home consumption, under the authority of the Electricity and Fluid Exportation Act for the year ending March 31st, 1911, is given in the following table. It will be seen that the Ontario Power Company generated the largest number of units and that a considerable portion of this amount was used in Canada. The Canadian Niagara Power Company exported practically all its production, while the Elec-

trical Development Company only exported a very small fraction of the total. At St. Frances practically all the power generated was used in the United States, and this is also true of the New Brunswick company. The total shows that less than 1/3 of the total amount generated at or near the international boundary was utilized in the operation or development of Canadian industries.

The total number of telephone companies reported to this department as at date June 30th, 1911, was 537. This number is made up largely in Ontario and Saskatchewan stock companies, as in Alberta and Manitoba the telephone systems are chiefly controlled by the governments. The total number of miles of wire is given as 687,728, made up of 576,713 urban and 111,015 rural. The number of telephones in use was 302,759. Capital invested is placed at \$40,043,982.

The number of miles of telegraph land lines operated by the Dominion Government is 8,150; cables 256 miles. The number of miles of land lines by provinces is Newfoundland 14, Nova Scotia 766, New Brunswick 78, Quebec 2,120, Ontario 28, Northwest Provinces 1,376, British Columbia 1,156, Yukon 2,612. In addition to the government lines there are nine companies operating as follows:—the Great North Western Telegraph Company, 10,726 miles of line and 50,568 miles of wire; the Canadian Pacific Railway Company, 13,-

TABLE SHOWING AMOUNT OF ELECTRICAL ENERGY PRODUCED FOR EXPORT AND FOR HOME CONSUMPTION FOR YEAR ENDING MARCH 30, 1911.

Companies.	Units generated or produced for export.	Units generated or produced for consumption in Canada.	Total output of generating station or othersources.
Ontario Power Company of Niagara Falls, Niagara Falls, Ontario	195,379,851	130,590,049	325,969,900
Canadian Niagara Power Company, Niagara Falls, Ontario	301,874,204	12,410,696	314,284,900
Electrical Development Company of Ontario Ltd., Niagara Falls, Ontario	24,609,100	111,220,067	135,829,167
Ontario and Minnesota Power Company, Fort Frances Ontario	14,669,679	566,340	15,236,019
Maine and New Brunswick Electrical Power Company, Ltd., Aroostook Falls, N.B.	1,798,591	43,739	1,842,330
Totals	538,331,425	254,830,891	793,162,316

386 miles of line, comprising 87,703 miles of wire; the Western Union, 2,598 miles of line and 11,599 miles of wire; the Temiskaming & Northern Ontario Railway, 294 miles and 3,299 miles respectively; the Algoma Central Railway, 214 and 517 miles; the Grand Trunk Pacific Railway, 1,963 and 6,004 miles; the North American Telegraph Company, 44 and 783 miles; the Canadian Northern Railway Company, 4,367 and 13,073 miles; the Transcontinental Railway, 313 miles of line.

Electricity Farm Tests

The Electrical World of August 3rd contains a brief description of an estate where good use has been made of electricity supplied over a 3 phase, 6600 volt transmission line. A 15 h.p. motor mounted, with its starter, on a portable truck can be moved about the farm to drive a corn husker, shredder, wood saw and thresher. Another 3 h.p. motor drives a deep well pump delivering the water supply for the estate to a reservoir on the hill top. A ½ h.p. motor pumps cistern water, and the laundry is equipped with a motor driven mangle. Tests were recently made at this farm to determine the power required for various farm operations. For example it was shown that 1750 bushels of barley were threshed with an expenditure of 220 kw. hrs. the maximum demand being 20.5 kw. In this particular section of the country it costs \$20 a day to hire a steam thresher.

In a series of 10 minute tests to find the amount of power required by a corn grinder running idle it was found that the motor alone consumed 0.106 kw. hrs. and the motor and grinder 0.341 kw. hrs. Tests were then made on the

energy consumed in the operations of grinding corn, showing an average of 40.7 bushels per hour consuming 0.411 kw. hrs. per bushel.

Equipment and Maintenance of Telephones

A pamphlet is being distributed from the press of the Legislative Assembly of Ontario containing extracts from a report on the Independent telephone systems of Ontario and containing also an article written by the Board's telephone adviser, Mr. Francis Dagger, on the subject of "Municipal ownership of rural telephone systems." In this article some interesting information is given of the working of the new telephone act and some figures on the cost of installation and operation of a number of municipal telephone systems in different parts of the provinces.

In the following table compiled from this report column A represents the number of subscribers in the different companies named, column B the original cost of the system per subscriber, column C the annual assessment to subscribers for 10 years in repayment of the cost of the system with interest at 5 per cent., and column D the annual payment by subscribers for cost of operation.

	A	B	C	D
Brussels	700	88	*11.36	
Tuckersmith	505	56	8.37	\$3.50
Chinguacousy	412	73	9.00	†3.00
Maidstone	247	44	5.85	1.00
Rochester	240	41	5.44	1.00
Sandwich South	219	65	8.42	2.00
Gosfield North	206	43	5.83	2.00
Blyth	203	93	*12.00	
North Easthope	200	65	*10.50	
Colchester, North	173	40	5.72	\$3.00
McKillop	167	66	9.72	\$3.50
St. Vincent	144	57	7.95	\$7.00
Colborne	125	44	†8.00	
Goderich	105	48	†7.95	
Laird	101	38	4.22	
Tay	100	59	9.00	

*Includes cost of operation.

†For five years, plus each payment of \$15.00.

\$Do not own central switchboard and pay Bell Co. for switching.

†Pay Bell Co. for switching half system.

It is pointed out that the payments under B cease at the end of ten years, the original debt being wiped out. It must not, however, be understood that at the termination of this period subscribers will obtain service at the figures given at the article under heading D as provision will then be made for such construction and renewals of plant as may from time to time be rendered necessary by depreciation and obsolescence. The cost of this provision will have to be assessed against the subscribers, in addition to the amounts now paid for operation and ordinary maintenance. What the actual amount of such an assessment would be depends very much upon the quality of the equipment and the manner of its construction when the system was first built. For this reason it is important that municipal systems be well constructed and only the best equipment adopted in the first place, as a badly-constructed system, with inferior, because cheap, equipment, may require almost total replacement at the end of ten years, which would necessitate the continuance of an assessment nearly approaching the figures in column C.

With a properly engineered and well built system, using high-grade equipment, a yearly amount not exceeding half the original assessment should be ample to take care of all necessary repairs and reconstruction. Assuming this to be so, in a system such as Chinguacousy, the subscribers of which now pay \$9 in repayment of principal and interest,

plus \$3 cost of operation, would at the end of ten years pay \$4.50 plus \$3, or \$7.50 per annum, instead of \$12 as at present. In considering this matter there is, however, another element to be considered, which is that the Act provides for additional subscribers paying the same assessment as the original subscribers who shared the cost of building the main pole leads and of equipping a central office to accommodate many more telephones than were installed at the start. It will be apparent that the cost of connecting additional subscribers using the same central office equipment and pole leads which have already been paid for by the original subscribers, is very much less than the amount paid by these original subscribers. This difference is set aside by the municipality as a reserve fund to be expended on maintenance, re-construction and extensions, and it is within the range of possibility that by the end of ten years this fund may have reached a proportion which would considerably reduce the amount to be assessed against subscribers on account of depreciation or obsolescence.

Rubber Covered Wire Regulations

Mr. F. A. Cambridge, city electrician, Winnipeg, has sent out the following notice with reference to rubber covered wire requirements in that city after January 1, 1913. Winnipeg's action is important and may well be followed by a similar course in every city and town in Canada with a view to preventing at as early a date as possible the further installation of inferior grades of wire,—

"Please take notice that from and after January 1st, 1913, this department will require that all rubber covered wire to be used in buildings shall meet the following regulations:—

(1) For all 500 volt installations, also service entrance wiring for 110 and 220 volt system in iron conduit, 30 per cent. Para rubber covered wire must be used in every case.

(2) For all interior wiring for 110 and 220 volt systems, whether the same is in conduit or not, new code rubber covered wire must be used. No new code wire will be accepted for use unless the coils bear the underwriters' inspection labels showing that the same has been inspected at the point of manufacture.

(3) The manufacturers have agreed to carry stocks of new code wire in Winnipeg in ample time to meet the above requirements and you are hereby warned not to lay in stocks of the old code wire that would be on your hands after January 1st, 1913, as this department will not accept such wire for use after that date."

Electric Truck Savings

The General Motors Truck Company of Detroit have issued a sketch booklet indicating the development and present status of these modern successors to the horse. It is pointed out that the modern electric truck is taking such an important place in the scheme of city delivering and trucking that to-day electric power men are actively investigating storage battery vehicles. Not only do they see an opportunity to develop off-peak service connections but they feel the necessity of being just as familiar with the electric truck as with the advantages of direct drive in shop or factory, electric elevators, or any of the other current consuming devices regarding which their customers are apt to inquire.

The natural advantages of the electric truck are outlined under the subheads of cost, time saving, space occupied, operating advantages. Tables are given showing the up-keep cost and operating costs for trucks varying in capacity from 1,000 to 12,000 lbs. In these tables the upkeep varies from \$1.50 for the smallest size to \$4.90 for the largest size, per day. For the same range of capacity the fixed charges vary between \$1.40 and \$2.80 per day so that the

total charge under these two heads varies from \$2.90 to \$7.70. Under heading "up-keep" is included the cost of all chassis repair parts, and tire and battery replacements. "Fixed charges" cover interest at 6 per cent., amortization at 10 per cent. on chassis, and miscellaneous items such as insurance, licenses, sundries, etc.

Under the heading of operating costs, a flat garage rate per month for the 1,000 lb. capacity machine of \$40 is given increasing to \$70 for the largest machine. This includes all electricity, storage, washing, garage attendance and the garage profit as well. The cost of electricity alone for charging batteries, calculating at a rate of 4c. per kw. h., is 50c. per day for the smallest machine and \$1.35 for the largest.

The booklet quotes from a paper by Mr. W. P. Kennedy read recently before the Commercial Motor Vehicle Manufacturers as indicating the economy which may be effected in large installations. The figures showing the results in eight cases were given in this paper where the number of horses originally required varied from 16 up to 75 and where later they were replaced by storage battery trucks numbering from 5 to 44 respectively. In each case an annual saving resulted which amounted to \$4030 in the smallest installation and to the very considerable sum of \$39,539 in one of the others, though this was not the installation where the largest number of motors was installed. These savings work out in no case to less than 14 per cent. on the original investment and in the most favorable installation represent 52.3 per cent. clear gain.

Electric Features of the Exhibition

Among other new electrical features to figure prominently at this year's exhibition, the Hydro-electric Power Commission of Ontario have taken a large space in the Process Building where various kinds of farm machinery will be operated by electric power. In this way it is the intention of the commission to demonstrate the possibilities of electric power to the farmers who will assemble at the exhibition from all over the Dominion. It is safe to say that there is no section of the entire exhibit that will be visited with greater interest, or profit to the rural communities of Canada.

Another feature of special importance to electrical men will be the first exhibit of electrically operated automobiles manufactured in Canada. The advantages of the electric automobile as a pleasure vehicle and the electric truck for utility work are now being generally recognized and the value of storage battery operated vehicles are receiving correspondingly careful attention at the present time. The possibilities of the all-Canadian car, built by the Peck Electric Co. of Toronto merits the most careful study of exhibition visitors. This car will be shown with both chain and direct drive, the latter being made possible by a specially wound slow speed motor of new design. A most noticeable feature of this latter car is its perfect noiselessness. A speed up to 40 miles an hour can be developed by these machines and distances varying from 60 to 75 miles are made on a single charge.

Local improvement by-laws for the inauguration of an ornamental standard system of lighting were introduced at a recent meeting of the North Vancouver Council. The improved lighting system will be given a trial on Lonsdale avenue and First street and extended as the demand grows. The by-laws cover the construction and installation of the standards on Lonsdale avenue from First street to Eighth street, and on First street from Forbes avenue to St. David's avenue, the cost for the Lonsdale avenue lights being estimated at \$12,000, and those on First street at \$14,000. Arrangements are also being made to have a similar installation from the waterfront to First street.

Gas-Electric Vessel for Canada

Canada is to have the first electrically propelled vessel constructed on a commercial basis. The vessel is for the Montreal Transportation Company, and will be built from designs by Messrs. J. Reid & Co., of Montreal and Glasgow. Messrs. Swan, Hunter, Wigham & Richardson, Eng., will construct the hull, and the engines will be manufactured by the Electric Marine Propulsion Company of Glasgow. The vessel will have Diesel engines, which will operate dynamos, and the electric power thus developed will be used for driving, through motors, the screw and the other mechanical equipment of the vessel, the captain directing them by switches from the bridge. The electrical system is the invention of Mr. H. A. Mayor, of Glasgow.

The vessel will be for the Lakes traffic, and will have a deadweight capacity of 2400 tons gross on 14 feet. The machinery will consist of two 300 h.p. high speed Diesel engines, each with its own alternating current generator and exciter. On the propeller shaft just ahead of the thrust block will be fitted a special compound-wound squirrel-cage induction motor, turning the usual form of lake propeller at about 80 revolutions per minute, as compared with the 400 revolutions of the Diesel engines. A very simple arrangement of switches controls the flow of current for varying speed or reversing, with a certainty of response quite impossible on a direct Diesel engine drive. It was found, as the result of the running of "The Toiler," the first boat fitted with Diesel engines, on the lakes, that the high speed at which the engines worked made them unsuitable for direct connection with the propellers as, when turning too fast, they simply thresh the water without giving proportionate propelling power, while the speed actions necessary for canal work were hard to obtain. It was in order to overcome this that the idea of developing electricity by oil engines and then using the current for operating the propeller and other machines was conceived.

Mr. John Reid points out that the peculiar conditions of our canal traffic have caused Canada to lead the world in experimenting with these new methods of propulsion. The absolute limit of hull and propeller capacity for the canal work has been reached, and the utmost limit of cargo capacity has been attained at about 2,200 tons. The only way to improve this with the present canals and locks is to reduce the weight of the engines. This was effected by the comparatively light weight of engines and fuel with oil engines, which meant an advance of 150 to 200 tons of cargo, or nearly 10 per cent. But this form of canal boat requires very large, coarse pitched propellers turning up to 80 revolutions per minute, while the large oil engines of the Diesel type have to run from 150 to 250 revolutions for successful work. This inconsistency in revolutions can only be got over by introducing a transmission or reducing gear. Electricity offers the best prospect of success in this respect and incidentally other advantages of a high order. For example, the total power of the propelling engine required in a single unit for direct drive can be split up with electrical transmission into two, three or more sub-units, each with its own generator, all connected to a single propelling motor. Further, all speed changes and reversing can be done by switches controlling the current supplied to the reversing propelling motor, and the control station can be placed in any convenient spot in the ship: in the engine room, wheel house or elsewhere. While oil engines are used to generate the power, and under the most suitable conditions for successful running, the propulsion through the electric transmission remains the same as if a steam engine of the usual type were coupled to the propeller, with all the handiness and reliability for which the marine steam engine is unequalled.

National Association for Testing Materials

The 6th Congress of the National Association for Testing Materials will be held in the Engineering Society's Building at 29 West 39th street, New York city, on September 2-7, 1912. Delegates will be present from all parts of the world representing practically every phase of industrial development in the various countries. A very large number of papers have been prepared which will be available beforehand for study and will be presented at the Congress only in abstract form.

An interesting feature of the Congress arrangements is the rule that the time for each abstract will be strictly limited to a maximum of two minutes. Abstracts of the papers are also being prepared and distributed beforehand. The scope of the subjects discussed in the papers is as wide as it is possible to make it. Tests of very many kinds will be reported such as the "elongation and ductility of steel rails," "tests on concrete," the "consideration of the magnetic and electrical properties of materials in connection with their mechanical testing," "electrolytic action on reinforced concrete," "temperature effects on the physical properties of certain alloys," etc.

A Valuable Book

Electrical Injuries—their causation, prevention and treatment; by Chas. A. Lauffer, A.M., M.D. Price 50 cents. This book is designed for the use of practical electrical men. In the preface the author points out that the management of many American railroads and other industrial establishments provide for the instruction of employees in first aid and in the avoidance of perils incident to their work. The author believes that this movement merits the approval of all electrical workers as being economical and profitable to the employer and at the same time an indication to the employee himself that his physical welfare is being safeguarded. The policy of many companies provides for the instruction of employees in the theory and practice of the art of artificial respiration. By prompt action at resuscitation many lives have been saved and results have shown, over and over again, that men who have received this instruction have been enabled to render much more effective service in emergencies. The author adds that a large number of employers in the electrical field have sent inquiries to his company and to these, instruction cards have been sent out for use in power plants and central stations. He adds that this intelligent interest among employers and employees in the mutual effort to avoid tragic electrical deaths augurs well for the eventual industrial triumph of electricity as a human agency fully as safe as gas or water.

It is with the appreciation of the interest taken by electrical men generally and in the hope that the pages submitted may be of further value that this little book is published. It is devoted chiefly to electrical injuries, their cause, symptoms and prevention, with a certain amount of discussion on the theories connected therewith. A few pages are also taken up under each of the headings "minor surgery and first aid," "infections," and "the effects of occupation on the health." The book is published by John Wiley & Sons, New York and London, through their Canadian agents, the Renouf Publishing Co., 25 McGill College avenue, Montreal, and should undoubtedly be in the hands of every electrical worker.

Work has commenced on the new Bell Exchange Building on Park avenue, London, Ont. This is in line with the general policy of enlargement and development being followed by the Bell company throughout Canada.

An Ordinance Requiring Certain Electrical Equipment in Order to Prevent Damage by Electrolysis

The problem of electrolysis of underground pipes by stray electric currents has been attracting attention in Chicago for some time, as serious leaks in the water pipes have been shown to be due to this cause. The city council recently passed an ordinance intended to prevent a continuation of past conditions which was worded as follows:—

Section 1. All uninsulated electrical return circuits must be of such current-carrying capacity and so arranged that the difference of potential between any two points on the return will not exceed the limit of twelve volts and between any two points on the return 1,000 feet apart within one mile radius of the City Hall will not exceed the limit of one volt, and between any two points on the return 700 feet apart outside of this one-mile-radius limit will not exceed the limit of one volt. In addition thereto a proper return-conductor system must be so installed and maintained as to protect all metallic work from electrolysis damage.

The return-current amperage on pipes and cable sheaths must not be greater than 0.5 ampere per pound-foot for caulked cast-iron pipe; 8 amperes per pound-foot for screwed wrought-iron pipe and 16 amperes per pound-foot for standard lead or lead-alloy sheaths of cables.

Section 2. All persons, firms or corporations operating railways must equip their uninsulated return-current systems in the following manner:

First: With insulated pilot-wire circuits and voltmeters so that accurate chart records will be obtained daily showing the difference of potential between the negative bus-bars in each station and at least four extreme limits on the return circuit in its corresponding feeding district.

Second: With recording ammeters, insulated cables and automatic reverseload and overload circuit-breakers which will record and limit the maximum amperes drained from all the metallic work (except the regular return feeders) to less than ten per cent. of the total output of the station.

The said chart records must be so kept as to be always accessible to city officials.

Section 3. Any person, firm or corporation failing to comply with the provisions of this ordinance after nine months from the date of its passage shall be fined not less than \$50 nor more than \$200 for each offence; and each day's operation of such equipment contrary to said provisions shall constitute and be regarded as a separate and distinct offence.

Programme for the Sixth Annual Convention of the Illuminating Engineering Society to be Held at Hotel Clifton, Niagara Falls, Ont., Sept. 16 to 19, 1912

1. Report of Committee on Progress. This report will deal with the recent progress and developments in the lighting industry both in this country and abroad.

2. A Report of the Committee on Nomenclature and Standards, which will deal with certain definitions and terminology of illuminating engineering.

3. "Steel Mill Lighting"—a report of the committee on illumination of the Association of Iron and Steel Electrical Engineers—to be presented by the chairman, Mr. C. J. Mundo.

4. "High Pressure Gas Lighting," by F. W. Goodenough. Chairman of Council, Illuminating Engineering Society, London, Eng.

5. "The Status of High Pressure Gas Lighting," by Mr. George S. Barrows. This paper will be a collation of do-

mestic and foreign correspondence pertaining to high pressure gas lighting.

6. "Recent Developments in Gas Lighting," by Mr. R. F. Pierce.

7. "Indirect and Semi-Indirect Illumination," by Mr. T. W. Rolph.

8. "Recent Developments in Series Street Lighting," by Dr. C. P. Steinmetz.

9. "Research Methods," by Dr. E. P. Hyde.

10. "The Problem of Reterochromatic Photometry and a Rational Standard of Light," by Dr. H. E. Ives.

11. "Reflection from Colored Surfaces," by Mr. Claude W. Jordan.

12. "Diffuse Reflection," by Dr. P. G. Nutting.

13. "A Study of Natural and Artificial Light Distribution in Interiors," by Mr. H. Luckiesh.

14. "The Physiology of Vision," by Dr. T. A. Doodruff.

15. "The Efficiency of the Eye Under Different Systems of Illumination," by Dr. C. E. Ferree. This paper will be a report of a research carried on for the American Medical Association.

16. "A Proposed Method of Determining the Diffusion of Translucent Media," by Mr. E. L. Elliott.

17. "Illumination Charts," by Mr. F. A. Beauford.

18. "The Determination of Illumination Efficiency," by Mr. E. L. Elliott.

19. "An Absolute Reflectometer," by Dr. P. G. Nutting.

20. "Colored Values of Illuminated Surfaces," by Mr. Bassett Jones, Jr. This subject will be presented in the form of a series of experimental demonstrations.

One session will be arranged for at which discussions will be in order on miscellaneous phases of illuminating engineering. It is expected that this session will bring out interesting and valuable points not particularly covered by the above papers and reports.

The scenic wonders of the Falls render possible an entertainment programme which will surpass that given at any previous convention of this society.

Inspection tours of the power houses and other wonderful development enterprises peculiar to this location have been arranged for.

Reduced railroad fares will be available for delegates.

3000 kw. Vertical, Synchronous Booster, Commutating-Pole Rotary Converters—Largest of their Type

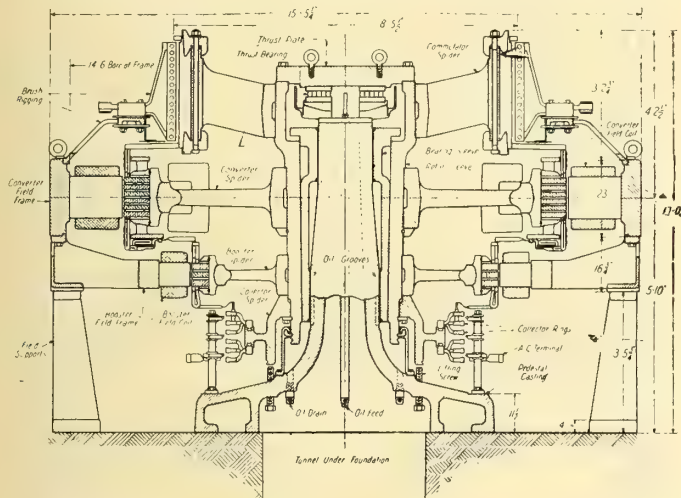
Two 3000 kilowatt, vertical, synchronous booster, commutating-pole, rotary converters have just been built and tested by the Westinghouse Electric & Manufacturing Company in its East Pittsburgh works. These two machines, which are of unusual interest, because they are the largest vertical rotary converters ever constructed and because they are the only vertical converters ever built involving the synchronous booster and commutating pole features, are for the New York Edison Company for installation respectively in their Clinton and Crosby street sub-stations.

The converters deliver a normal direct current voltage of 270, and are for 25 cycle, 6-phase operation. The direct current voltage variation obtained by virtue of the booster feature is 15 per cent. buck and 15 per cent. boost from the normal voltage, giving a total direct current voltage variation of 30 per cent. These machines were made of the vertical type to conform in general construction to the other converters in the sub-stations, all of which are vertical machines.

The accompanying sectional drawing shows the detail construction of the machines. The converter armature and frame are mounted above the booster armature and frame. The commutator is at the top of the machine and the col-

lector rings at the bottom. The armature consists of a rotary converter armature of the usual construction mounted on the same shaft with the smaller booster armature, which is connected in series with the converter armature so that when the booster field excitation is varied, the alternating current voltage impressed on the converter armature will be decreased or increased accordingly.

The main or converter poles are shunt wound. The commutating poles which lie between the main poles have been so wound that variations in armature reaction introduced by the booster are taken care of. The copper grids imbedded in the main pole faces do not extend from pole to pole as in ordinary machines but are cut off flush with



Showing detail construction of converter

the sides of each main pole. This construction is used on all commutating pole converters, which forms the most effective starting and damping winding. The booster poles are shunt wound, and the booster field is arranged for hand regulation. Provision is made for effectively cooling the commutator by the insertion of copper heat-radiating vanes in the upper end of each commutator bar. Ample space is provided between commutator necks which extend from the commutator bars to the armature coils, and through these spaces the cooling air is forced by the rotation of the machines. A commutating pole converter which is to be started from the alternating current end must be provided with a brush lifting device, but inasmuch as these machines are to be started from the direct current end, a brush lifting arrangement is not necessary.

Some of the mechanical constructional features are unique and different from any heretofore used for vertical electrical machines. The pedestal on which the armature rotates, and which is plainly shown in the figure is a one piece, hollow steel casting having a large area of base. With this construction a much more rigid structure results than with the usual one wherein a steel pedestal with flange on its lower end is bolted to a cast iron base. The pedestal is tapered so that the upper bearing is smaller in diameter than the lower one. This facilitates assembly. The bearings proper are babbitted and cast in a sleeve which can be readily taken out of the converter spider for re-babbiting.

A roller thrust bearing is arranged at the top of the pedestal to take the weight of the revolving element. The bearing rests on a plate which has a spherical seat carried on the pedestal so that perfect alignment is assured. The roller bearing can be taken out by removing the top plate of the machine. To assume the weight of the rotating part at times when it is necessary to remove the top plate, six $1\frac{3}{4}$ in bolts are provided that turn through the lower portion of the pedestal flange. When it is necessary to take

off the top plate, these bolts are screwed up until they raise the rotating element a trifle and assume its weight.

Lubrication is effected with a gravity oiling system. The oil is drawn from reservoirs and forced up through the oil pipe in the center of the pedestal. At the top of the pedestal, the oil discharges through a nozzle into a cylindrical chamber within the roller bearing. The pressure on the oil forces it from this chamber out between the bearing rollers into an annular pan surrounding the roller bearing. Oil cannot leave the chamber except through the bearing, and the height of the outlet nozzle and the oil pan rim are such that the bearing rollers always travel in a bath of oil. When the oil overflows from the pan around the roller bearing it passes into an annular chamber just above the upper pedestal bearing. From this chamber its only exit is through oil grooves in the pedestal. While it is passing through these grooves, the rotating babbitt bearing surfaces take up oil. From the upper pedestal bearing the oil flows down through the chamber around the shaft to oil grooves for the lower bearing similar to those above described. From the lower oil grooves, the oil discharges into an annular reservoir to the lower part of the pedestal from which it drains into a storage reservoir to be circulated again through the lubricating system. An effective oil thrower arrangement is provided at the upper part of the oil space and around the lower part of the pedestal which effectively prevents oil creepage up the shaft.

General Electric Company Pays 30% Stock Dividend and Authorizes Bond Issue of \$60,000,000

The announcement has been made by the General Electric Company of a 30 per cent. stock dividend declaration in addition to the regular quarterly dividend of 2 per cent. The directors have also authorized an issue of 5 per cent. debenture bonds, limited to \$60,000,000. The dividend disbursement will amount to more than \$23,000,000. Shortly after the announcement was made the company issued the following statement:

"It would seem unnecessary to make any further statement, but in view of the fact that the sale of rights to new stock is being discussed on the street, it should be stated that no new stock is being offered for subscription, the \$30 per share not being an offering of 'right' in any sense, but a direct distribution of stock from the surplus earnings of the company, in partial recognition of dividends which in prior years have been omitted or reduced. An issue of debentures was authorized for the purpose of securing capital for the varied corporate securities of the company from time to time in future years."

The company's present financial position is made clear from the April balance sheet reproduced in the following table:

Balance Sheet, April, 1912

Assets	
Real estate and machinery	\$19,987,877
Merchandise	30,905,405
Cash and debts receivable	35,693,266
Patent rights	14,809
Miscellaneous	28,955,175
	<hr/>
	\$115,556,532
Liabilities	
Capital stock	\$77,581,200
Accounts payable	5,412,841
Funded indebtedness	2,560,000
Surplus	30,002,491
	<hr/>
	\$115,556,532

Vancouver and the Pacific Coast

Power Plant No. 2 under construction at Burrard Inlet by the B.C.E.R. Co. Three Units with aggregate capacity of 40,000 h.p. 4 runner Doble wheels and Dick Kerr Generators

On August 1 the British Columbia Electric Railway Company, Ltd., started operations on the construction of a new hydro-electric generating station on the North Arm of Burrard Inlet. This station will be known as Power House No. 2, it being located on the shore of the North Arm at a point about 2,000 feet south of the company's present hydro-electric generating station, which will hereafter be known as Power House No. 1. The service which will be provided by the new station is demanded by reason of the extraordinary growth throughout the company's territory on the southern mainland of British Columbia, the area of which is about 1,600 square miles and includes the cities of Vancouver, New Westminster, North Vancouver and the municipalities of South Vancouver, Point Grey and the entire South Fraser Valley from the coast to Chilliwack 75 miles up the Fraser, as well as districts on the north side of the Fraser River.

The output from Power House No. 1 is now 43,500 h.p. The plans for Power House No. 2 call for the installation of equipment capable of an output of over 40,000 horse power, thus making about 85,000 horse power available from the company's two hydro-electric generating stations. In addition, the company has a steam auxiliary plant in Vancouver capable of an output of 20,000 horse power, thus rendering available over 100,000 horse power of electric current for the southern mainland of British Columbia.

Power House No. 2 a view of which, taken from the artist's sketch, is given with this article, will have a frontage of 213 feet on the North Arm; its width will be 70 feet and its height 80 feet. On the site of the building was a granite cliff extending to the water's edge, and for some months the work of clearing at the point has been in progress, the removal of many thousands of cubic feet of rock being necessary. This material will be utilized in the construction of the building as it is to be of reinforced concrete. A large stone crusher was installed in connection with the clearing operations and the rock necessary for construction purposes was thus made available on the ground.

The appearance of the power house from the Inlet side is imposing. As may be seen from the sketch 8 piers rise from the ground line to the roof, each being 8 feet wide and 6 feet thick. In the reinforcing work great care has been taken to make the building exceptionally strong, nearly 100 tons of steel being used for this part of the work.

The interior of the building is divided longitudinally into two parts. On the Inlet side it will be two storeys in height with the balance of the building divided into three storeys. The section of the building facing the inlet is 40 feet in width. On the ground floor will be located the hydraulic and electrical equipment for the three large units, to accommodate which the building was planned. On the upper storey will be placed the high tension switches, these being directly connected with the generating equipment on the floor below. The steel beams over the first floor of this section of the building will be 15 in number, each being 40 feet long, 4 feet 6 inches deep, 2 feet 6 inches wide and weighing nearly a ton.

In the rear portion of the building provision is made

on the ground floor for the accommodation of the busbar equipment. The second floor will be used to accommodate the low tension switches necessary in connection with the plant and on the third floor will be placed the banks of transformers.

The roof of the building will be supported on steel trusses and the plans for the equipment call for two overhead travelling cranes, each of a capacity of 50 tons in the main generating room and an overhead travelling crane of 20 tons capacity in the transformer room.

The site of the B.C.E.R. power houses on the North Arm of the Inlet is exceptionally advantageous for the supply of construction material. The point is not touched by steam railways or vehicular roads, but transport is easily arranged by water. The depth at the power houses is considerable and the Canadian Pacific Railway frequently sends its transfer barge, 45 feet wide and 190 feet long, laden with 12 full sized cars, direct to the power house wharf. By



Power House No. 2—Burrard Inlet

means of an apron track the cars run from the barge to the wharf and into the power house, the machinery then being handled by the overhead travelling cranes.

The water supply for the power house will be derived from the same source as that which is utilized for power house No. 1, being delivered at a head of 400 feet. This is comprised in the Coquitlam-Buntzen water power, a description of which appeared in the Electrical News recently. For the new power house the water is taken from the southwestern portion of Lake Buntzen and conveyed through a hydraulic tunnel which was driven through the granite cliff lying between the lake and the power house site. This tunnel is about 2,000 feet in length, 15 feet internal diameter, and cement lined throughout. In the driving of the tunnel, two shafts were sunk at distances of 400 and 900 feet from Lake Buntzen. The tunnel was then driven from five faces,—in each direction from the foot of each shaft and from the cliff above the power house site. At the intake of the tunnel three Doble needle-nozzle intake valves will regulate the flow, these being placed on a concrete foundation at the lake bottom. These valves are operated by oil pressure and will be electrically controlled from the operating bench board in the power house.

After passing through the tunnel the water is carried into a steel surge tank, 30 feet in diameter and 90 feet in height, which will be installed in a shaft excavated in solid rock. From the surge tank to the power house the water

is carried by means of steel pipes, each 8 feet 6 inches in diameter at the intake and 7 feet in diameter near the power house. In these steel pipes Doble Venturi butterfly valves will be installed. A separate pipe line is provided from the surge tank for each of the three units to be installed. Close to the power house this pipe is divided into 4 branches, each branch supplying water to one of the four runners comprising each unit. On each branch a Doble



Pontoon Tramline across Lake Buntzen

hydraulically operated gate valve is provided which controls the admission of water to two needle nozzles which direct the water to the buckets of each wheel.

The speed regulation of each unit will be controlled by a Lombard governor operated by oil pressure. The main nozzles are opened and closed according to the load on the unit by the action of this governor through links attached to the rocker shaft. Should the load of the unit fall off suddenly two relief nozzles are opened by the action of the governor. These are made adjustable to the profile of the pipe lines and in this manner it was arranged for a minimum loss of water combined with a maximum factor of safety. As a result of the installation of the relief nozzles, the manufacturers gave a guarantee of regulation as follows:—25 per cent. decrease, 2.5 per cent. regulation; 50 per cent. decrease, 6 per cent. regulation; 100 per cent. off, 10 per cent. regulation; 100 per cent. on permanently, 2 per cent. regulation; with full load taken off suddenly a maximum pressure rise in pipe line not over 12 per cent.

The hydraulic units were manufactured by the John McDougall Caledonian Iron Works, licensees for all Doble patents in Canada, at their works in Montreal. This company is also providing the hydraulic equipment throughout. The water wheels are stated to be the largest single impulse wheels yet constructed and were designed by Mr. W. A. Doble, chief engineer of the Pelton Water Wheel Company of San Francisco. Each of the three units weighs 410,000 lbs. and consists of four runners, mounted on a hollow nickel steel shaft 51 feet 3 inches long. Each of the four runners is equipped with Doble patent ellipsoidal buckets. The normal output of the wheels is rated at 14,000 h.p. each and the guaranteed efficiency is noted by the manufacturers as follows:—Half load, 82 per cent.; $\frac{3}{4}$ load, 83 per cent.; full load, 85 per cent.; $1\frac{1}{4}$ load, 84 per cent., this guarantee making a remarkable flat curve.

The electrical equipment for the new power house will be supplied by the Canadian General Electric Company, the Canadian Westinghouse Company and the Dick, Kerr Company. The contract for the three generators has been award-

ed to the Dick, Kerr Company of London, England, and the equipment is now being built at the firm's works at Preston, Lancashire. Each unit consists of one Dick, Kerr 8900 kv.a., three phase, 60 cycle, alternating generator, directly driven at a speed of 200 revolutions per minute, and generating current at 2,200 volts. In the rear of each unit is located a 300 h.p. exciter unit. This unit consists of a Dick, Kerr induction motor-generator set direct driven by two Pelton-Doble water wheels mounted on the end of the shaft. The speed of the exciter is 600 revolutions per minute and the current is generated at 250 volts, being fed either direct or through d.c. busbars to the field of the generator. The high tension switches, located on the floor of the main generating room, are of the Canadian General Electric K-15 type and are suitable for 60,000 volts. In this room is also contained the lightning arresters which are of the electrolytic type and of the latest design provided by the C. G. E. Company.

At the rear of the main generating room is the compartment in which the a.c. busbars are installed. These are located in cell structures at the rear of the exciters, and the voltage regulation is controlled by the action of a Tirrill regulator on the exciting current. Above the busbar compartment is a room in which will be installed the low tension generator and transformer switches. These are all of the C. G. E. H-6 type.

Above the low tension switch compartment is located the transformer room. The transformer equipment of the station will consist of 4 banks, each composed of three 3,000 kw. single phase, 60 cycle, oil-insulated, water-cooled transformers, by means of which the voltage will be raised from 2,200 to 34,600. At a later date the transformers will be "Y" connected, thereby increasing the voltage to 60,000.

The B.C.E.R. Company's new power house represents the most advanced practice of hydro-electric experts, the best features of European and American design having been combined to give a plant which will undoubtedly be one of the



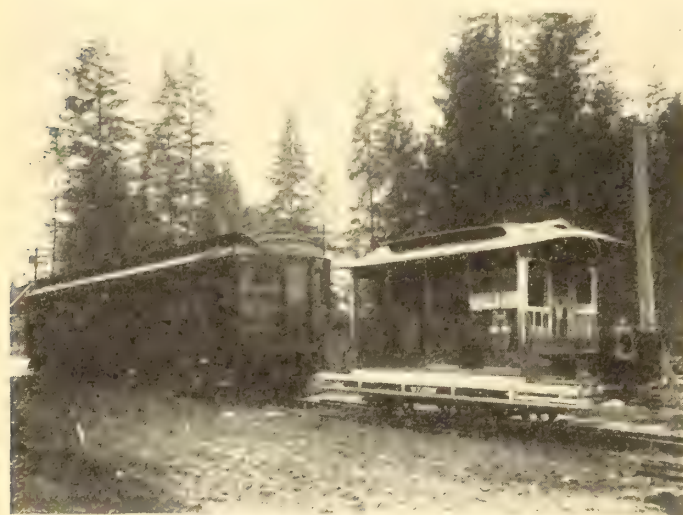
General view Power House Site No. 2

finest on the Pacific Coast. Work on the new power house is being pressed vigorously and it is the expectation of the company's management that the first unit will be placed in service by the end of the present year.

The Victoria city council recently accepted the tender of Hutchison Bros., a local firm, for installing a lighting system on portions of Government street and Dallas road. The contract price for the first mentioned thoroughfare is \$10,350, and for Dallas road \$6,648.

Electric Railway Picnic—Two Perpetual Challenge Cups and Many Prizes

The picnic given by the management of the B. C. Electric Railway Co. for its employees and their families, held at Hastings Park, Vancouver, July 24th and 25th was a great success. There was an attendance of over 6,000, and the general opinion is that the relations of the company with its employees were placed on an excellent footing through the effort made for their pleasure. One feature of the picnic was the illustration of the growth of the B. C. Electric as shown by the placing of the first car of the Vancouver street railway, side by side with one of the latest interurban cars intended for use on the Fraser Valley division, a reproduction of which accompanies this article. The old car is known as Number Ten and was first operated on the Vancouver lines in October, 1890. For a number of years it did good service but as larger and better cars became necessary its electrical equipment was removed and the car used as a trailer. It is worthy of note that this old car was partially equipped and it and its companion car oper-



1890 to 1912. B.C.E.R. picnic exhibit

ated by Mr. J. B. Rannie, now Traffic Agent for the B. C. Electric and one of the committee having in charge the arrangements for the picnic.

The programme for each day consisted of sports, etc., in which the employees and their families took great interest. Two perpetual challenge cups were offered. The general manager's cup for the best tug of war team was won by the Vancouver division of the street car men. The Conway cup was awarded for the pole climbing contest. Two poles 45 feet in height were placed in the ground and the teams competed in climbing these poles and going over the cross arm. The New Westminster team was victorious, one of its members, Mr. Fletcher, performing the feat in 52 2/5 seconds, thereby creating a new record on the Pacific coast.

General Manager Sperling and the management of the company were on the field during the progress of the picnic and took an active part in its direction. At the close of the second day the prizes were awarded by Mrs. Sperling.

Power Possibilities of British Columbia

The work of investigating the power possibilities of the rivers of British Columbia inaugurated last year, was resumed a few weeks ago under the direction of Mr. Arthur V. White of the Canadian Commission of Conservation, who has charge of all work of this nature in Western Canada. Three engineering parties are now engaged examining the Fraser River and tributaries between Lytton and Fort

George. This embraces one of the largest drainage basins on the continent.

The report on the water powers of Canada issued by the commission a few months ago drew special attention to the fact that the waterpowers available for development from an economic standpoint are fewer in number and potentiality than is popularly supposed. Their findings have an important bearing on the question of conserving these powers in the public interest in view of the new towns and cities springing into existence in British Columbia. In the report the commission promised that special investigations would be carried on in the prairie provinces and British Columbia, because all the required data was not available at the time of publication. The waterpowers of the Kootenay River have already a profound economic influence in the Kootenays and Boundary district. Similarly the same is expected to be effected by the Adams River waterpower throughout the Shuswap lake district and South Thompson river country where irrigation is being resorted to.

West Kootenay Co. will Add 4,500 kw. Unit

The management of the West Kootenay Power and Light Company stated recently that in anticipation of the electrification of the Canadian Pacific Railroad in B. C. from Rossland to Castlegar next year, the power plant would be much enlarged in regard to its power producing machinery. The C.P.R. also contemplate the electrification of their other branch lines in the Kootenay district in the near future, and in order to meet this demand, the power company will find it necessary to install another unit of 6,000 horse power as an addition to the two of this capacity already there. This will make a total capacity for power house No. 2 of 19,800 horse power. This plant is situated at Upper Bonnington Falls which is in addition to a 4000 h.p. development at Lower Bonnington.

At the present time the No. 2 plant, which is situated on the Kootenay river near Nelson, is supplying power to the mining and smelting companies all through the West Kootenay, extending as far as Boundary Falls, a distance of 84 miles, and it requires all the power supplied by the two 4,500 kilowatt Canadian General Electric generators to meet the present demand. In addition to the extensions mentioned, the power company intends to commence construction of some 300 feet of wing dam this year, and later to extend the dam completely across the river.

Hotel Vancouver's New Power House

Work was recently completed on a reinforced concrete building to be used by the Hotel Vancouver as a power house and laundry. The building is situated in the rear of the hotel and is six storeys in height besides having space underground for the boilers, electric generators, etc. the work of installing which has already been commenced. There are three boilers each of which develops 400 horse power at a working pressure of 150 pounds. These boilers will furnish the steam for the engines which will drive the electric generators and for the laundry machinery. Three engines will be required for the generators, two of 380 horse power each and one of 125 horse power. The generators themselves are three in number, two of 175 kilowatts capacity and one of 75 kilowatts. These will supply light for the hotel and will also furnish the power to run the ice making machines, two in number, which will have a capacity of twenty tons per day each. Within a short time work will be completed on the reinforced concrete chimney which will rise to a height of 225 feet above the level of the street. As soon as the machinery can be installed in the new plant the present power house and laundry will be torn down leaving the way clear for the contractors to excavate for the new ten-storey hotel addition.

Progress in the Prairie Provinces

Winnipeg Hydro-Electric Power Development —Features of Terminal Station

The accompanying cut affords a very good example of the latest developments in the nature of open wiring in the high tension rooms of switching stations. This shows the 60,000 volt layout of the city of Winnipeg's terminal station in Winnipeg. This is in decided contrast with the system of barriers and switch cells thought necessary for this class of work not many years ago.

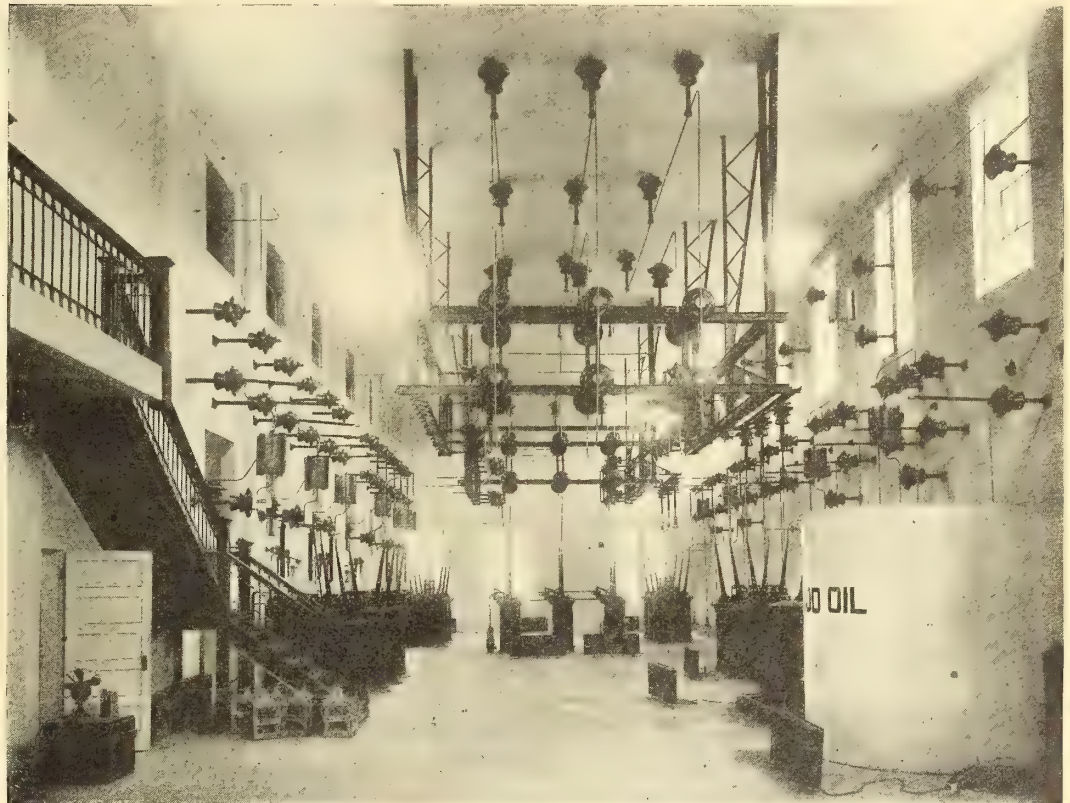
As may be noted from the cut, the two incoming lines enter the switch room through the five foot square openings in the earthen compartments back of the left wall of the room. Of the disconnecting switches on this wall, one in each phase is for the main line switch and the other is for the electrolytic arresters, to which they are led through the openings below the line of disconnecting switches. From the disconnecting switches the line goes through the current transformers, one in each phase, into the oil circuit breakers and thence to the disconnecting switches on the structure.

A direct connection is made across the structure to the disconnecting switches of the transformer circuit breakers on the opposite side of the room. A tap is taken off this line and carried through disconnecting switches to the bus circuit breakers, one of which is shown in the centre of the floor, while the other is to be installed in the future. The main 60,000 volt bus bars, which are in reality but tie connections between the lines at present, are shown suspended from the ceiling. On the right are the transformer oil circuit breakers, each of which is equipped with a series time limit relay, as shown, suspended from the structure work. From the circuit breakers the current is carried through choke coils to the delta connections which are shown on the wall. Disconnecting switches are placed inside the delta connections. The lines run through floor tubes into the transformer compartments beneath. As the dehydrating equipment for treating oil is mounted on this floor, the tank marked "good oil" shows up in the cut as well as the electric heaters shown on the floor. All of the bus bar work is of copper tubing three-quarter in. outside diameter, and smooth joints. The circuit breakers are electrically operated with the condenser bushings. The nature of the structural work is quite apparent from the illustration, and it may be noted that this is quite rigid. All of the equipment shown was manufactured and installed by the Canadian Westinghouse Co. of Hamilton. The walls and ceiling of this room are

finished in white, and the whole makes a very pleasing appearance.

Light and Power for St. Vital

Another municipality adjoining Winnipeg, which has finally decided to avail itself of the advantages of better transportation facilities and electric light and power is St. Vital, lying on the east side of the Red River, and south of Winnipeg. The councillors of the municipality have made an agreement with the Winnipeg Electric Railway Company whereby that company receives a thirty year exclusive



Layout of City of Winnipeg, 60,000 Volt Terminal Station

franchise for a street railway system and for a distribution system for light, heat, and power, and for twenty years of the term are exempt from taxes except for school purposes and local improvements. The company agrees to give a service throughout the municipality by November 1914, and to have a line in operation as far as St. Vital road by November 1913. This is about four miles from the center of the city, and in the heart of a beautiful suburban district which should be rapidly built up in a short time. A single city fare will be charged as far as Park Road avenue, and from there to St. Vital road additional fare will be charged. This will, however, be reduced to single fare when the population per mile reaches 800. The work of extending the distribution system will be commenced immediately. A sewage system will also be installed in the municipality.

The Arcola Electric Light & Power Company has been incorporated in the province of Saskatchewan.

The Watrous (Sask.) Electric Light, Power & Traction Company has increased its capital from \$25,000 to \$50,000.

Automatic Telephones in Saskatoon—Present Capacity 2,000. Ultimate 6,000—Municipally Operated

In Saskatchewan the Provincial Government owns and operates the telephone systems of the province. In 1911 they bought from private interests the telephone exchange in Saskatoon. Since then they have erected a fine four-storey brick building and rebuilt the entire system. The outside construction work is all new, the cables in the business part of the city being underground. They have installed an automatic telephone system, manufactured by the Automatic Electric Company, Chicago. This is the two-wire system and the latest type of automatic apparatus.

The building is completely modern with excellent heating and lighting systems; each floor well supplied with toilet rooms and lavatories. They have also installed a complete vacuum cleaning plant, the piping of which extends to all parts of the building. The entrance corridor, the front office, and the toll room have a special cork flooring. This flooring is made up of small squares of cork about one-half inch thick, laid in glue, and it makes a good looking as well as serviceable floor.

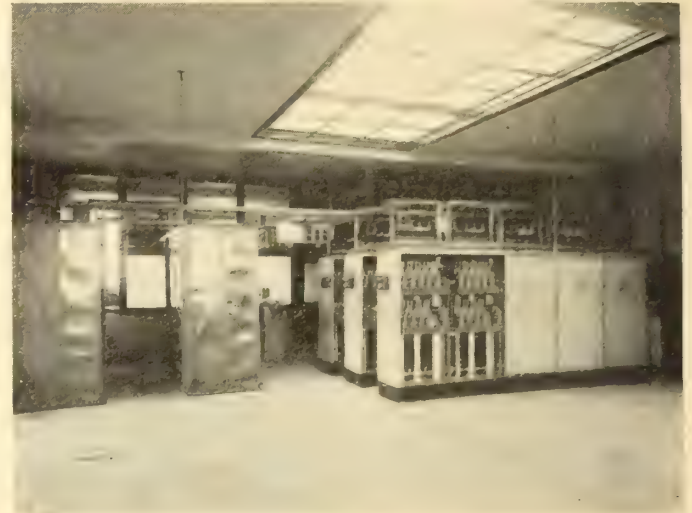
The first floor of the building is devoted to general business offices. The toll booths also are on this floor. The basement contains the storage battery and a gasoline engine charging set. The storage battery was made by the Electric Storage Battery Company, Philadelphia, and consists of 25 G. type cells, each equipped with two positive and three negative plates. It has a present capacity of 320 ampere hours with an ultimate capacity of 800 ampere hours. This system being equipped with only one battery, a set of seven counter e.m.f. cells is used to regulate the voltage at the automatic switchboard. This regulation is accomplished by means of a switch being so connected that as the voltage rises, due to charging the battery, these counter cells may be cut into the switchboard circuit and the voltage reduced. The leads from battery to power board are of 500,000 circular mils cable. The gasoline engine charging set consists of Jager engine directly connected to a special noiseless Holtzer-Cabot dynamo.

On the second floor of the building there are the rooms for the toll and farm line boards, also the information desk.

A room on this floor is furnished for a rest and waiting room for the toll and farm line operators.

The third floor is divided into two rooms; the one containing the main distributing frame, wire chief's desk, power board and ringing machine; the other, the automatic switchboard.

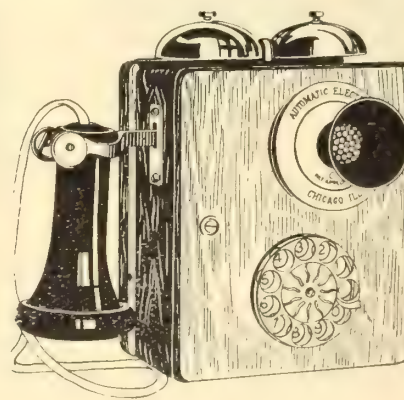
The power board is of black Monson slate and is made up of five panels. On the first panel are mounted circuit



View of the Saskatoon Automatic Switchboards, before the installation of the 500 line addition. To the right are the line switch units for 1500 lines, arranged in three rows of five units each. Some of the doors are slid aside showing the connector switches mounted on the rear of each line switch unit. In the left half of this picture are the two racks carrying the trunking switches, one for first selectors and the other for second selectors.

breaker, rheostat, and switches for gas engine charging set; on second panel are counter-cell switch, voltmeter and main battery fuses; on third panel a differential type ammeter and various switches; fourth panel, the rectifier charging set; and fifth panel, the ringing machine consisting of duplicate sets of harmonic converters.

The differential type ammeter used in this exchange is so constructed that it shows the amount of current that the battery is receiving during a charge, regardless of how



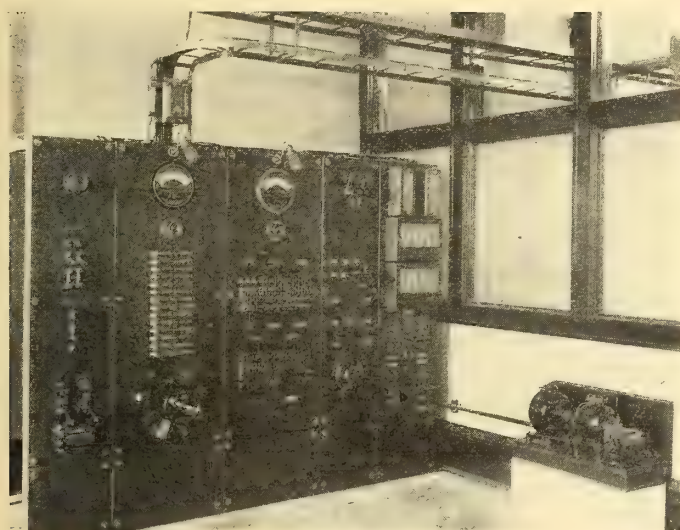
The accompanying cuts show the central office building and types of wall and desk phones in use in Saskatoon's Automatic Telephone System.



much current is being supplied to the exchange at the same time. The rectifier charging set is of the Canadian General Electric Company's manufacture, with charging rate of forty amperes. The main distributing frame consists of 15 columns, each column holding 200 lines. Most of the underground cable running into the building is 200 pair. The 100 pair wool cables are spliced to each of these in the basement and carried up through a chute to the main distributing frame and there fanned out to 25 pair line terminal blocks.

The switchboard room is well lighted by windows and skylights, which makes it an excellent workroom for the men in charge of the switchboard. The first equipment installed was for 1,500 lines, but it was found necessary to enlarge the capacity immediately and a 500 line addition was installed, making the present capacity for 2,000 subscribers. The ultimate capacity of the switchboard room is about 6,000. There are no party lines in this exchange—each subscriber having a private line.

The new exchange has been in operation since the middle of June and the demand for telephones is so great that



Power switchboard and ringing machine, Saskatoon

more additions will be needed very soon. Saskatoon is growing so rapidly and covering such a large area that branch exchanges will soon be built.

Mr. J. N. Bonnell, of the Automatic Electric Company's staff, was engineer in charge of the installation of the entire central office equipment. The system was built in accordance with plans furnished by and under the supervision of the Provincial Engineering Department, of which Mr. W. W. Warren is engineer-in-chief.

Activity in Calgary

The ratepayers of the city have carried a by-law for \$200,000, towards additional electric light extensions, as owing to the continued rapid development, additional money was needed to carry on the work of this department. Connections are being made at the rate of 400 per month, and during the past month over 1,000 h.p. additional motor load has been connected. A contract has also been awarded to the Dick, Kerr Company, for one 500 kw. synchronous motor-generator set, to be placed in the new Ogden sub-station, which will be used for operating street railway service to the new C. P. R. car shop district. Preparations are now being made to pull in 12,000 feet of 12,000 volt cable, supplied by the Canadian British Insulated Company, and the new west end sub-station is now nearly completed. The

two 3,000 kv.a. transformers, 12,000 to 2,300 volts, are enroute from the Canadian Westinghouse Company's factory and will be installed immediately, as it is the wish of Superintendent Brown to have these in operation to take care of the anticipated heavy fall load.

The city council has at last approved of the apportionment of the cost of installing and maintaining the five-light standard lamps. The property owners will pay the cost of the installation, including all underground work, transformers, etc., and the city as a whole will pay the cost of maintenance. The matter of installing ornamental lamps has been delayed for over a year on account of the difficulty in arriving at the proper apportionment of the cost, but it is now expected that all the principal business streets will be illuminated in the near future. On the main business street, on which the street railway operates, inverted magnetite luminous arcs will be used and fastened on ornamental brackets to the street railway trolley poles. Each lamp will give about 2,500 candle power, and it is fully anticipated that Calgary will have one of the most brilliantly lighted thoroughfares in the Dominion.

Commissioner A. G. Graves has been granted leave of absence, and will pay a visit to Great Britain, and while there, will incidentally investigate the operation of gas engines for lighting and power purposes. He will return by Toronto, on or about the 25th of October, and will from that point visit various plants in the United States. Natural gas has recently been piped into the city of Calgary, and it is expected that additional electric power will be required in the very near future, and as the present hydro-electric power is limited, it is thought that this new source will be utilized, providing the investigations into the subject prove satisfactory. In the meantime, however, the city are arranging to equip 2,000 h.p. of their stand-by steam plant with natural gas under the boilers. The rate charged by the gas company is 15c per 1,000 cu. ft., for power purposes where over 500,000 cu. ft. are used per day; if less than the above the charge is 20c.

The City Commissioners have recommended to the city council the reduction of lighting rates from 9c per kw.h. with 15 per cent. discount to 7½c per kw.h. with 10 per cent. discount, with still lower rates for larger consumers. The above recommendation has been approved and goes into effect in the near future.

Moose Jaw

Contract has been awarded for a 500 kw. turbo-generator to the Canadian General Electric Company. This unit is to be arranged so that steam may be led off for heating purposes if necessary. The tender of the same company has also been accepted for 160 arc lamps and cut-outs, together with station equipment. Four hundred service boxes will be supplied by the Canada Brass Company. The C. G. E. Company will also supply 250 12-in. and 60 16-in. Alba globes. A number of 60-watt and 100-watt lamps of different makes will be purchased and tested before deciding which type will be used throughout the city.

At a recent meeting of council Commissioner Rundlett was requested to make a report on street railway conditions, especially as to whether the company were living up to their franchise agreement. This report has been presented and states that work is well advanced on the present extensions and that with regard to the amount of trackage required under the by-law the company has more than fulfilled the conditions. The same is also the case with reference to the number of cars operated and the service given. The company have been granted the right to construct still further extensions.

North Battleford

The city is installing a 550 kv.a. 3-phase electric generator, which will have a capacity of 10,000 lamps. Large additions are being made to the power house building to accommodate the installation of new engine, generator, additional boilers, and additional coal storage. Also extensions are being made to the arc lighting system. Fifteen miles of additional distribution pole lines are being erected this year, and it is estimated that upwards of 500 additional electric light consumers will be added to the system before the end of the year. Considerable additions and improvements are at the same time being made in the general illumination of the streets of the city to the extent of fifty additional 6.6 series arc lamps, and fifty-five five-light ornamental tungsten standards. This will greatly improve the general appearance and illumination of the streets. A 24-hour service was put on January 1st last, since which date a large number of motors and heating devices have been installed, resulting in a profitable day load. Mr. M. D. Cadwell, superintendent of water and light, is in charge of all extension work.

Transcona

The town of Transcona is preparing to handle the greatly increased population which will certainly follow the opening of the new Transcontinental shops and a number of other large industrial enterprises in that vicinity, and are preparing plans and calling for tenders for an extensive sewer system, sidewalks, paving, and street lighting. The contract for the town lighting and for power for the pumping plant has been awarded to the Winnipeg Light and Power Dept., and there will be installed at present 62-6.6 amp. series tungsten lamps and 8-6.6 amp. arc lamps. The rate for lighting consumers will be 5 cents a kilowatt hour and for power 2/3 of a cent. higher than the regular Winnipeg schedule. The work of installing the distribution system will be commenced immediately. Both the Winnipeg Electric Railway Co., and the Light and Power Department may compete for business. The W. E. Skinner Co., Limited, are consulting engineers for the town.

W. E. R. Stonewall Branch

The right of way for the Stonewall branch of the Winnipeg, Selkirk, and Lake Winnipeg Railway Company has been secured and work will be commenced on the grading as soon as possible, for according to the terms of the agreement made with Rockwood, cars must be running by the first of December. The branch will leave the present line just beyond the present Middlechurch sub-station, and will run in a northerly direction about ten miles to Stony Mountain and thence about seven miles to Stonewall. It will be a single track line, with 600 volt direct current trolley, and the cars will be similar in design to those now operating on the Selkirk line. This line will run through a more or less undeveloped country for a large part of the way, but which is practically suited for dairying, and this will be encouraged by the better traffic facilities afforded by the new line which will carry freight and express as well as passengers.

The I. E. E. in Canada

Mr. T. Harding Churton, a member of the council of the Institute of Electrical Engineers, Eng., has been on a visit to Canada, going right through to the Pacific Coast. Mr. Churton, while in Montreal, had a conference with Mr. Lawford Grant (managing-director of the Canadian British Insulated Company, and hon. secretary-treasurer of the In-

stitute in Canada), and also with prominent Canadian electrical engineers on the question of membership in Canada. A number of electrical engineers in the Dominion are members of the Institute, and Mr. Churton discussed certain proposed developments.

Telephones

Tenders for telephone exchange stations have been received by D. C. McNab, deputy minister of Railways and Telephones for the Province of Saskatchewan for the erection and installation of exchanges at Rosetown, Waldock, Guernsey, Kennedy, Loreburn, Vibank, Imperial, Tyvan, Radisson, Markinch and Langenburg.

The new telephone rates for the province of Manitoba outside of Winnipeg, as prepared by the Manitoba Government's telephone commissioner, have been issued. The statement is made that the larger towns where subscribers receive greater value should have higher rates, not only on account of the greater service rendered, but because the larger the exchange the greater the expense of operating per unit instrument. This statement, however, is one that has been discussed very widely, and when advanced by the Bell company some months ago, was, on different occasions, disputed by their opponents. It is evidently a question that must be considered as depending more or less on local conditions and efficient management, and cannot be looked on as capable of solution by any single investigation.

Miscellaneous

Every effort is being made to have the street railway system in Lethbridge ready for the Fall Fair held during the latter part of August. Five p.a.y.e. cars are being supplied by the Preston Car Co. and the work of construction is in charge of Mr. H. Doughty, former superintendent of railways in Regina.

The Montreal and Southern Counties Railway Co. propose to make another addition to their many extensions. The latest is a belt line running from the old Vermont Central line, now being electrified, to Chambly, Greenfield Park, the golf links, and St. Lambert. The company have asked for a 20-year franchise from the town of Greenfield Park.

Among the money by-laws that are to be submitted to the ratepayers of Winnipeg September 13, is one for \$1,800,000 for the extension of the pipe system to Poplar Springs, about seventeen miles from the city. They would include 13200 volt transmission lines, transformer stations and electrically driven pumps, and it is also understood would include \$250,000 for a stand-by steam plant for the electrical system. \$750,000 is also asked for additions to the present electrical distribution system.

A commission appointed by the State of New York for the purpose of investigating the various public utilities systems of Canada spent several days in Winnipeg gathering a large amount of data concerning conditions here. A very comprehensive report covering the results of their investigations will be presented to the New York legislature on their return to the States. The party comprised Senator and Mrs. Ferris of Utica, Geo. W. Coumee, A. J. Baldwin, and P. B. Bolton of New York, and C. H. Jackson of Albany. It is understood that they are investigating particularly the relation of publicly owned utilities to those in private hands, and that their report will cover recommendations for the future operation of these in the state of New York.

Montreal and Eastern Canada

Grand'Mere Power Development

Tenders are now in for a municipal scheme to develop power for a lighting system for the town of Grand'Mere, P.Q., from plans by Messrs. Surveyer & Frigon, Montreal. The town has hitherto been supplied by the Grand'Mere Electric Company, who obtained their power from the Shawinigan Company, but the council desires to have a plant of their own, and accordingly plans have been drawn up. The Electric Company were invited to make an offer to sell their plant, with a view to the council extending it in the event of the offer being acceptable. At first only 300 horse power will be developed, with a possibility of increasing it to 600, while if the storage in the upper lakes of the river is utilized 1,200 horse power can be obtained.

The proposal is to develop power at the Thibodeau Fall, on the Shawinigan River, about seven and one-half miles from Grand'Mere. The transmission line, 11,000 volts, 3-phase, will begin at the proposed site of the power house on the Shawinigan River, and end at the outside wall of the substation situated near the Town Hall. The power house will be built at the foot of the last fall, on the Shawinigan River. The poles for the transmission line will be thirty feet long with four-pin cross arms. The insulators are to be of porcelain, standard make, 11,000 volts. A two-wire telephone line of No. 8 B and S weather-proof copper wire is to be installed on the transmission line, and will be transposed every fifth pole. In the event of the entire plans being carried out, the lines of the distribution system are, where they cross any existing line, to be installed at least four feet above the highest wire now existing, and three feet above the wires of the Bell Telephone Company. When the new distribution system is installed, the present wires of the Electric Company will be removed. The transformers will be supplied by the town.

The street lighting system will consist of two series 4 ampere circuits of 100 c.p. drawn filament tungsten lamps. The wire used will be No. 6 B & S weather-proof double braided all through. One hundred and twenty-five lamp fixtures are to be installed.

Montreal Tramways

The statement of the finances of the Montreal Tramways Company, for the first fiscal period ended 30th June, cannot be compared with that of previous periods owing to changes consequent upon amalgamations. The statement is for nine months, and shows gross earnings of \$4,355,403, with net \$1,736,459. The city percentage on earnings comes to \$279,030; interest on bonds and loans \$449,513; interest on debenture stock \$600,000; and taxes, \$50,850, leaving a surplus of \$357,066, from which \$150,000 has been appropriated to contingent account and the balance of \$207,066 transferred to general surplus. The ratio of expenses to earnings for the nine months was 60.13 as compared with 56.12 in the last statement of the Montreal Street Railway. The president, Mr. E. A. Robert, states in his report that the ratio of expenses to earnings is satisfactory. Car earnings per passenger were favorable, showing 4.06 cents per passenger as compared with 3.94 cents per passenger in the last street railway statement, and 3.04 cents per passenger total carried as compared with 2.93 cents. The passengers carried in the nine months were 139,406,275 or at the rate of 185,000,000 a year. Last year the old Montreal street railway carried 158,756,625. At the annual meeting the directors were re-elected, Mr. E. A. Robert being subsequently

re-elected president, and Mr. J. W. McConnell vice-president, while Mr. P. Dubee and Mr. J. E. Hutcheson were appointed treasurer and general manager respectively.

Mr. James E. Hutcheson, the new general manager has now taken up his duties. In officially announcing his retirement, to become the president of the Montreal Tunnel Company, Mr. Duncan McDonald, the late manager, has issued a circular letter to the employees of the company, expressing his regret at resigning and his appreciation of the good work done by the staff generally. Mr. M. Kennedy, the general freight agent of the company, has also resigned, having accepted a position with the Montreal Tunnel Company.

There have been renewed discussions in the Council concerning overcrowding of the cars and the request of the Tramways Company for sanction to additional routes in the down-town district. In reply to the usual bitter attacks on the company, Mr. Robert, the president, has stated that it is futile to put the blame on the company when the Council delay sanction to measures which will relieve the congestion. A committee, consisting of Messrs. Janin and Barlow for the city, and Mr. Duncan McDonald for the company, recently went into the matter and made a report, but there it rests. The traffic is increasing every month, and this year has averaged a gain of a million and a half passengers per month, while the routes in the down town district are the same as ten years ago. The company, in order to facilitate traffic, are anxious to cut out some of the stops, but the proposal has met with very strong opposition on the part of certain aldermen.

Grand Falls Company, Limited

Following the passing of an act by the local Legislature of New Brunswick at its last session whereby the Grand Falls Company Ltd. were given power to absorb the Grand Falls Power Co. and the Grand Falls Water Power & Boom Co., it is understood that arrangements have been made for the development of the water power at Grand Falls on the St. John River. At this point there is a natural fall of 120 feet which it is proposed to raise by a dam to 130 ft. It is calculated that 120,000 h.p. can eventually be obtained. It is understood to be the intention of the new company to develop this power solely for the manufacture of pulp and paper though the ultimate full development would doubtless mean that power would be supplied to the surrounding district. Grand Falls is distant from Fredericton about 100 miles and from St. John about 160. Sir William Van Horne is president of the Grand Falls Co. Ltd.

Underground for Montreal

The Montreal City Council has received an application from the Comptoir Financier Franco-Canadian for permission to construct a system of underground electric tramways. It is claimed that the capital will be furnished by Parisian bankers, and that Parliamentary powers are to be asked in order to carry out the project. The present company is only a preliminary one, it being proposed to form a concern with \$100,000,000 capital as soon as the necessary authority can be obtained. First and second class cars are, it is stated by the promoters, to be run on the underground trains. First-class tickets are to be eight cents each, and second class tickets four cents. Workmen's tickets being sold at two cents each, good during certain hours. The trains will con-

sist of five coaches, one of first-class and four of second class, each coach holding about 110 passengers. Plans are being drawn by Parisian engineers. The council decided to await the full organization of the company before taking action.

Conduits on St. Catharine St.

At the meeting of the Quebec Public Utilities Commission in September the Montreal Commission appointed to prepare a scheme for placing electrical wires underground will submit plans for conduits for St. Catherine street. When these plans are approved, they will be turned over to the city council for tenders to be called. Meanwhile the Commissioners are at work on other streets, the general scheme being to deal first with the main thoroughfares in the downtown district. The work will take several years, as there are many difficult problems to be solved. All the wires of the various companies have to be placed in conduits, and as this involves dealing with several services, the Commissioners have had to fit their plans to the conditions of the different systems. In portions of St. Catherine street there was a perfect network of pipes underground, and, in planning the conduit, great care had to be taken in avoiding these.

Million Capital Increase

At the annual meeting of the Canadian Light & Power Company, held in Montreal, it was decided to increase the capital from \$6,000,000 to \$7,000,000, in order that the additional stock may be issued as required. It was stated that the dredging of the canal was progressing favorably and should be completed this season. When the dredging now going on is completed the company will have a capacity of 30,500 horse power. The directors were all re-elected: Messrs. F. Howard, E. A. Robert, Geo. G. Foster, K.C., Hon. J. M. Wilson, J. W. McConnell, N. Curry, J. M. McIntyre, R. N. Smith, Wm. C. Finley and F. J. Shaw. At a subsequent meeting of directors Mr. F. H. Wilson was re-elected president; Mr. E. A. Robert vice-president and managing director; Mr. H. R. Mallison was re-appointed secretary-treasurer, and Mr. D. K. Goodfellow assistant secretary-treasurer.

Dorchester Electric Contracts

The Dorchester Electric Co., Quebec, have let the following contracts: Building power station, Messrs. Byers & Anglin, Montreal, \$35,000; turbo-alternators, street lighting apparatus and switchboard, Canadian General Electric; boilers, Messrs. Babcock & Wilcox; chimney, Heinicke Inc., New York; condensers, Canadian Westinghouse Co.; boiler pumps and heater, Canada Foundry Co.; pumps, Buffalo Forge Co.; crane, Canadian Fairbanks Co. Work has been started on the power house, and the whole of the apparatus is to be installed and running by the 1st November next. The main equipment consists of 4 Babcock & Wilcox boilers, two 750 kw. turbo-alternators, 12 arc circuits and 10 incandescent street light circuits for the street lighting of the city of Quebec and the usual power and lighting circuits throughout the city, which have not yet been laid out.

Special Cars of Steel

Special electric cars are being constructed for conveying prisoners to the new prison at Bordeaux, just outside Montreal. They will be built of steel plates and will be completely closed in, there being no windows. The cars which will be in charge of two employees of the Montreal Tramways Company, will be the property of the Govern-

ment. A special switch will be installed to permit the vehicles to stand on a siding at the Court House, and a similar arrangement will be made at the jail in Bordeaux. The company will construct a siding from their Back River line, and the cars will be run from the main line to a point within the precincts of the prison proper.

Miscellaneous

Mr. P. T. Davies, president of the Montreal Electrical Society, has been on a visit to Great Britain.

Prof. Herdt, of McGill University, has been re-elected Montreal secretary of the American Institute of Electrical Engineers.

The new issue of the Bell Telephone directory in Montreal contains something over 40,000 names. This compares with about 39,000 in the latest directory for Toronto, which however, is not so recent.

The Bell Telephone Company have decided to build an exchange at Outremont, a suburb of Montreal, and the town council have amended the by-laws in order to permit this. All wires will be laid underground.

Mr. W. J. Thorold, director of the Canadian & General Trusts, Limited, of London, England, has been elected a director of the Sherbrooke Railway & Power Company to represent the English interests in the company.

The men of the Quebec Street Railway Company have been negotiating for an advance in wages, and asked for the following scale: First year men, 20 cents an hour; second year men, 23 cents, and third year men, 25 cents.

The town of Dorval, on the Lakeside, P. Q., is about to install a public and private system of electric lighting. The street lamps will be 223 tungstens of 75 watts capacity, placed on poles 125 feet apart, the current being delivered by the Montreal Light, Heat & Power Company at 2,200 volts. The current for house lighting will be delivered at 110 volts.

Montreal Tramways motormen and conductors of five years standing and over have been granted an advance from 22 to 24 cents an hour, while those having served from three to five years get 22 cents an hour in place of 21 cents, and first and second year men are to get 21 cents, as compared with 20 cents formerly. The new scale of wages is effective from July 1 last.

According to the annual report of the Quebec Railway, Light, Heat and Power Company, the gross earnings for the year were \$1,565,000, an increase of \$285,000. Operating expenses were \$733,000, an increase of \$71,000, while the net earnings were \$832,000, an increase of \$214,000. The company paid two dividends of 1 per cent. each during the year on its common stock; these, with fixed charges, etc., absorbed the sum of \$620,000, leaving a surplus for the year of \$212,000, or about 2½ per cent. on the common stock.

On September 3rd the shareholders of the Shawinigan Water & Power Company will be asked to sanction an issue of \$500,000 additional capital. The authorized capital stock of the company is at the present time \$20,000,000, of which \$10,000,000 remains unissued. The company's last issue of stock was \$1,000,000 issued in October of last year at 108. In February last it was stated that the directors would install three additional units of 15,000 horse power each as the power was required.

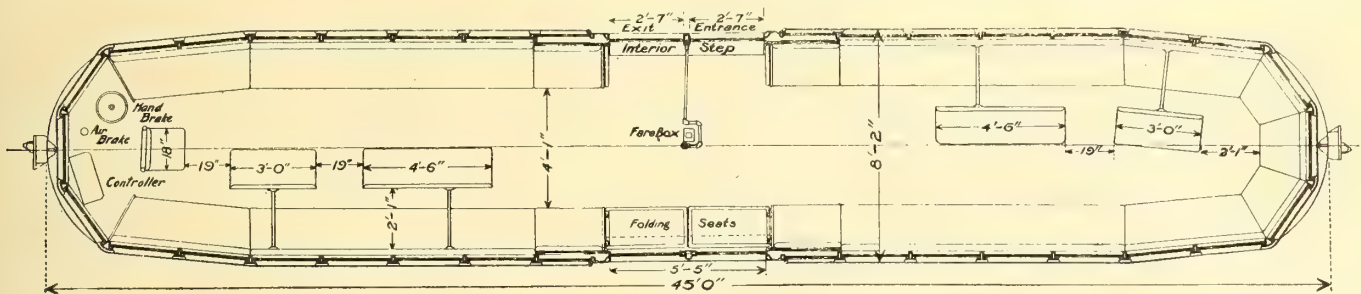
ELECTRIC RAILWAYS

Another Type of Low Floor Car—Follows Development of Small Diameter Motor

Another type of center entrance, low step, low floor car has just been placed in commission by the Pittsburgh Railways Co., and is described in a current issue of the Electric Railway Journal. Two years ago the Pittsburgh Railways Company put into service 50 very light trailer cars of the center entrance type, their distinctive features being the absence of interior partitions and bulkheads, a low floor level and the use of 22-in. wheels on the trucks. The officials became impressed with the easy-access features of these cars and decided to try one in operation as a motor car. The difficulty met however was that no motor could be found which could be mounted on axles with 22-in. wheels and yet give sufficient clearance to pass over obstructions on the street. As a result the railway company's officials then-

them. The intermediate seats are located only at the ends of the car in order to attract passengers away from the center door and thus reduce congestion. It is said that the plan works out well in practice and reduces to a surprising degree the difficulty of getting passengers to move away from the entrance after boarding a car. Along the center door opposite to the one in operation are two folding longitudinal seats each capable of holding two passengers. The seating capacity of the car is 67 with standing capacity for 46.

The motor, upon the successful design of which was based the entire plan for light, low-floor car, is of the inside-hung, spring-supported type. It is drawn out along the shaft and small in diameter. This attenuated feature of construction was necessary in order to obtain space for the material required in a motor of the desired capacity, since the maximum allowable diameter was restricted by



Unusual arrangement of seats. Car seats 67 and weighs only 487 lbs. per seat

selves designed and developed a motor under the direction of Mr. F. R. Phillips, superintendent of equipment, and Mr. P. N. Jones, general superintendent, which was designed chiefly along standard lines except that it was increased in length along the shaft, while the diameters of both armature and frame were materially reduced. The motor so produced can be carried upon a 24-in. wheel with a $3\frac{1}{2}$ -in. clearance or upon a 22-in. wheel with a $2\frac{1}{2}$ -in. clearance.

With the development of this small motor it has become possible to equip the low floor Pittsburgh trailers as motor cars and on one of them the under framing has been strengthened as necessary and the seat plan rearranged to make room for the motorman. The trailer body has been mounted on trucks with 24-in. wheels with one of the new motors on each axle and has resulted in a low floor, center entrance car, weighing, fully equipped, only 32,650 lbs. Since the seating capacity is 67 this represents 487 lbs. per seat. The most novel feature of the car body is the seating arrangement. Longitudinal seats are extended along both sides of the car (see figure), and around the rear end, since the car is equipped for single end operation only. At the front end 4 seats are cut out to provide room for the controller and brake valve, but one of these is saved by locating a single seat on the stanchion just back of the motorman. A curtain behind the motorman shields him from the glare of interior light. On each end of the wide space provided between the longitudinal seats are placed two intermediate seats also running lengthwise. One of these accommodates three and the other two passengers. These seats are slightly to one side of the center line of the car. Ample room for passengers on the rear seats remains and the supports of the insert seats are cut away at the floor to give sufficient room for the feet of the passengers moving about behind

the small diameter of the car wheel. The nominal rating is 30 h.p. for one hour with 75 deg. rise at 500 volts and with a draft of 58 amp. Its complete weight without gear and gear case is 1484 lb. The height of the floor of the car above the rail is somewhat less than 30 in.

P.A.Y.E. Cars in England

On June 25th the Mayor of Gateshead officially inaugurated the first pay-as-you-enter cars in Europe. The system has been adopted by the Gateshead and District Tramways Co. and their operation has been attended with all the success the officials of the company could have hoped. The main body of the car is 22 ft. 2 in. in length by 6 ft. 6 in. in width. The front and rear vestibules are each 5 ft. 1 in. in length, making a total of 32 ft. 4 in. Two doors have been provided at each end, one for entrance the other for exit. The platform is divided by a brass rod forming a light barrier. The conductor stands within the barrier and as the passengers enter they move across the platform, deposit their fares and pass through the door on the right.

By the adoption of this type of car the company expect to accomplish four main results. The conductor will be able to watch more efficiently over the safety of the passengers whether boarding or alighting; the collection of fares will be facilitated and ensured; the comfort of passengers will be increased as the conductor is no longer compelled to enter the car to collect the fares; and by reducing the time required to load and unload, better schedule can be given.

Mr. C. L. Huppert, managing director of the International Pay-as-you-enter Tram-car Company, in a brief address stated that the company with which he was connected

had worked the system successfully in 158 cities and had now in operation more than 16,000 cars. He explained that the idea originally emanated from the brain of a Scotsman and it would interest them to learn that he was also a Canadian.

It is understood that the Leicester Tramways Committee have decided to experiment with pay-as-you-enter cars as soon as possible. A universal penny fare is charged on the tramways in this borough.

Double Deck Trolley Cars for Pittsburgh

Officials of the Pittsburgh Railways Company, Mr. P. N. Jones, general superintendent, in an effort to solve some of the serious problems of transportation in Pittsburgh are experimenting with a double-deck car which will give a much larger seating capacity than the ordinary type. One of the objections to this design of car is the interference it will meet with from the ordinary overhead construction work, so that these cars will only be built to operate on certain routes and where there are no overhead bridges.

Quite recently the Pittsburgh company have scored a success with the center entrance, low step trolley car, using



Double-deck trial car on Pittsburgh Railway System

very small wheels which have been made possible by the use of a specially constructed "baby motor" of very small diameter and correspondingly increased length. This type of motor is being tried out on the double-deck car which will enable the company to keep the height within much smaller limits. The experimental car is 48 ft. long and will seat 110 passengers but if this design is adopted they will be built of all steel. On a trial trip 159 passengers were carried.

The city of New York is also trying out a double-deck low-step street car which if it meets with favor will probably be adopted on certain of their lines.

Saskatoon

The city of Saskatoon is making good progress with its street railway system. Grading has been done on several miles of line, and it is hoped that seven miles of track service will be in operation some time during the present autumn.

Personal Mention

Mr. H. D. Howe, secretary the Holophane Company, Limited, left the early part of August on a business trip to the Middle West, via the Great Lakes.

Mr. C. A. Howe, general manager of the Holophane Company, Limited, accompanied by Mrs. Howe, returned from Boston via the Maritime Provinces the early part of August.

Mr. E. P. Johnston has resigned the commercial managership of the British Columbia Telephone Company to become assistant secretary of the British American Construction Co.

Mr. Arthur V. White is at present investigating the unknown water-power possibilities in British Columbia. Mr. White will make a report to the Commission of Conservation of Canada.

Mr. W. V. Hunt, formerly connected with the B. C. Electric Railway as hydro-electric engineer, has been appointed to the position of electrical engineer of the company in the place of Mr. J. B. Ingersoll, who recently resigned.

Mr. E. W. McLennan has been appointed general superintendent of the city and provincial traffic department of the Manitoba Government telephone system. Mr. McLennan was formerly with the Bell company in Orillia, but four years ago entered the service of the Manitoba Government, with headquarters at Winnipeg.

Mr. Philip Mackenzie, for many years connected with the Bell Telephone Company, has formed a partnership with Mr. E. G. Shepherd, of the Stock Exchange firm of Shepherd & Company, Montreal. The firm will be under the name of Shepherd & Mackenzie, with offices at St. Francois Xavier street.

Mr. W. H. Scott, former local manager of the Bell Telephone Company, of Montreal, has been appointed general agent for the Manitoba Government telephone commission. Mr. Scott resigned from the Bell company on account of ill-health, but two years ago entered the service of the Manitoba Government telephone department.

Mr. R. H. Sperling, general manager of the B. C. Electric Railway Co., accompanied by Mrs. Sperling, left Vancouver on August 8th for an extended trip to the old country. While in London, Mr. Sperling will confer with the directors of the company concerning the affairs of the concern. During his absence the direction of the company's affairs in British Columbia will be left in the hands of acting manager G. R. G. Conway.

Mr. Alfred Still has been appointed Chief Electrical Engineer to the mining department of the Algoma Steel Corporation, with headquarters at Magpie Mine, Ont. This company is under the control of the Lake Superior Corporation of Sault Ste. Marie, Ont., and apart from the complete electric power equipment at both the Helen and Magpie mines, there is a hydro-electric power station now nearing completion which will supply power to the mines over an 18-mile, 3-phase transmission line. Mr. Still is an English engineer, well known as the author of standard books on electrical subjects and a frequent contributor of engineering articles to technical journals. He is a member of the Institution of Electrical Engineers, an associate member of the Institute of Civil Engineers and has recently been elected a member of the American Institute of Electrical Engineers. Mr. Still has only been in America about eighteen months, during which time he has been electrical engineer of the Lake Superior Power Corporation.

300,000 h.p. Plant on Mississippi River

Lowhead Development at Keokuk, Iowa—Power House to contain Thirty Units—Concrete Dam Nearly a Mile Long—Detailed Description of Hydraulic Features

A water power development of gigantic proportions is under progress on the Mississippi River near Keokuk, Iowa, at the foot of the Des Moines rapids, which from the great width of the river at that point and the necessity of making provision for a heavy steam boat navigation renders the construction work more than usually interesting.

The project involves the building of a solid concrete dam across the river, a power house, and a new lock and dry dock for the accommodation of river traffic. The U. S. government and the Mississippi River Power Company are jointly interested in the enterprise. The government secures free of cost a new lock and dry dock to replace the present canal and 3 docks which will be submerged by the new dam. The government secures also a new permanent navigable stage of water over a distance of 60 miles north of the dam. It is calculated that these improvements could not have been secured by the government under an expenditure of \$5,000,000.

The Mississippi River at this point is some 3000 feet wide. The power house is being constructed on the Iowa side of the river and the work of erection of this building and the installation of the turbine and electrical equipment is well advanced. The government lock is being constructed between the power house and the shore. The immense dam is being constructed from the Illinois side of the river and already is about three parts completed.

The dam, including abutments, will be 4568 ft. long 41 per cent. of which is built across a meadow on the Illinois side of the river and for which coffer-dams were therefore not necessary. This extra length of dam will be required however under the new conditions. The spill-way section of the dam will be 4278 ft. in length, spill-ways not being provided at the extreme Illinois end for a distance out of only about 300 feet. The height of the dam will be 32 ft. above the river bed and the base is 42 ft. wide. The up-stream face of the dam is built vertical, but the down-stream face is an ogee curve, the upper portion a parabola over which the water will spill, the lower portion an arc of a circle which will throw the water horizontally away from the toe of the dam.

The spill-way section will be composed of 119 piers and arches. On the top of the spillway will be placed 119 steel flood-gates 30 ft. wide and 11 ft. high, supported by concrete piers. These piers are 6 ft. thick and support the arched bridge from which the gates will be operated by electric hoists. The dam is being built entirely of concrete without reinforcements of any kind.

The power house will be 1400 ft. long and 123 ft. wide and will contain 30 generating units. The sub-structure will be built of massive concrete, the super-structure of concrete, brick and steel. The height of the power house from foundation to roof will be 133 ft.

To keep floating ice and logs from entering the power house an ice-fender is being built up stream from the upper end of the power house to a point on the Iowa shore. This fender will be 2,800 ft. long, built of solid concrete and to the eye will appear as a solid wall, separating the power house from the river, the submerged arches not being visible.

The accompanying illustrations will give a fair idea of the general type of work being executed in connection with these installations.

Power House

The power house will contain when completed 30 units of a turbine capacity of 10,000 h.p. each, only 15 of which will be installed immediately, however. The turbines are vertical shaft type, direct connected to the generator and will operate under a head of 32-35 feet. The draft tubes are of concrete and are now completed. The diameter of the upper end of the draft tube is 18 ft. and under normal conditions the velocity of the water at this point will be 14 ft. per second. At the lower end of the draft tube the enlargement is such that the discharge will be at the rate of 4 ft. per second. This reduction in velocity through the tube of the shape shown in the illustration, Fig. 1, showing the turbine design, is calculated to save to the total normal head of 32 ft. the sum of $2\frac{1}{2}$ ft. of effective head. In the cross-section here shown of the turbine it will be seen that the total power is produced by a 22-ft. head of water above elevation 503 and the head of 13 ft. as a result of partial vacuum in the draft tube. Each turbine will be enclosed in a wheel-chamber built of concrete masonry. This chamber is of spiral shape and is known as the scroll case. Water will enter each wheel chamber through four gate openings, the shape of the wheel chamber being so designed as to conduct equal amounts of water at uniform velocity to all parts of the circumference of the wheel. This is shown in Fig. 2 which is a plan indicating the method of conducting the feed water from the head bay to the guide vanes in front of the turbine runner.

The turbine which will operate in this wheel-chamber is of special design. The weight of each, including their casings, will approximate 1,000,000 lbs. The shaft of each turbine wheel will pass up through a circular pit in the concrete above the wheel chamber to the main floor level where it will be coupled directly to the shaft of the electrical generator. The supporting and lubricating parts of the turbine will be located in this pit which is 21 ft. in diameter—large enough to allow the assembled wheel to be lowered through it.

These circular pits are being lined with steel plate cylinders with heavy rings of cast iron at the top and bottom. These "pit liners" as they are called weigh, assembled, 106 tons. They are erected by being supported temporarily each on 8 concrete erection piers. When the steel pit liners have been set in place and surrounded by heavy concrete which will hold them in place, the erection piers are knocked out. These pit liners are calculated to hold up the entire weight of the turbine and revolving generator parts.

The pit lining is indicated in Fig. 1 by the cylindrical castings H and F double riveted solidly to the steel barrel G. This figure also shows the cylinder entirely surrounded by concrete, thus making it absolutely solid in every direction. The cylindrical casting is connected to the casting H by separate bolts 8 in. in diameter and 20 in number. These bolts perform primarily the work of keeping the castings I and H an exact distance apart so that the guide vanes may not pinch and work hard in their operations.

The Turbines

The turbines are of special design, a general outline of which is shown in Fig. 1, and the normal capacity of which will be 10,000 h.p. at 32 ft. head. The weight of the turbines including their casings will be approximately 1,000,000 lbs. each, and the weight of the rotating part of

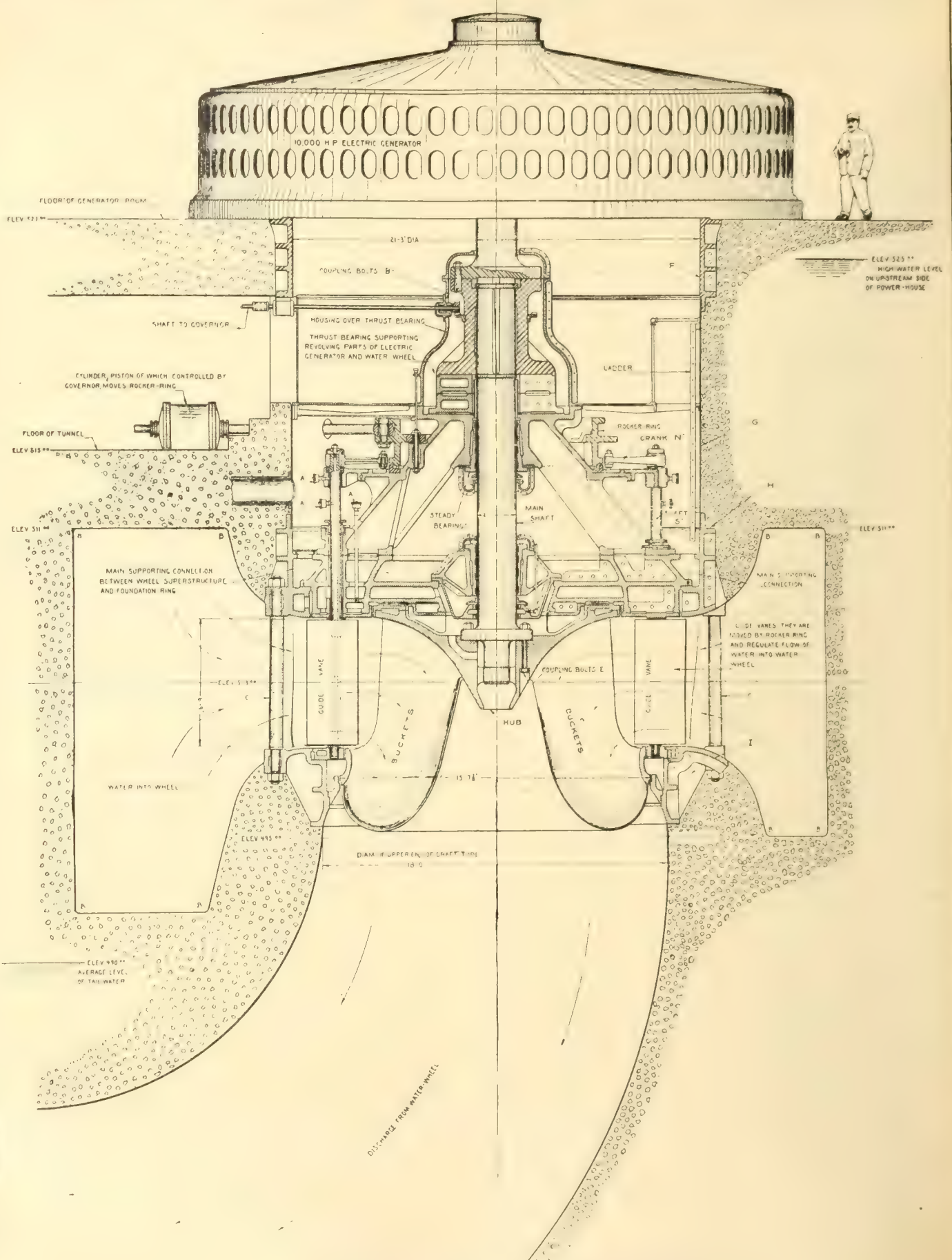


Fig. 1. Cross-sectional design of turbo-generator equipment on Mississippi River

each turbine together with the weight of the generator attached to it will be 550,000 lbs. The speed will be 57.7 revolutions per minute. The runner is 15 ft. 7 $\frac{7}{8}$ inches in diameter at its band and weighs about 140,000 lbs. The main shaft is 2 ft. 1 inch in diameter and about 25 ft. in length.

It is understood in the design of the Keokuk turbine, that competitive plans were secured from Norway, Germany,

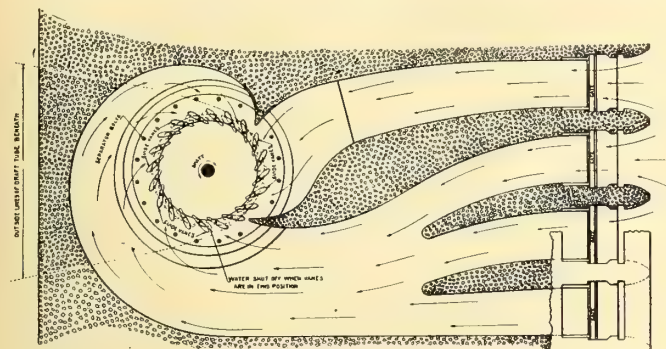


Fig. 2. Showing method of conducting water to turbines

Switzerland, Italy, France, and the United States, and with these in hand a committee was formed consisting of the chief engineer of two United States manufacturers and the chief engineer and the mechanical engineer of the Mississippi River Power Co. who were thus enabled to build up a new design based upon the best ideas taken from all the submitted plans.

In this particular design the total weight of the rotating part is carried on one thrust bearing only, thus avoiding the difficulties of distribution of weight with two or more points of support. The entire weight of the revolving part is therefore supported at the point marked "thrust bearing" and this thrust has two methods of carrying the weight. The first is by forcing oil between two circular bearing discs one of them stationary and one of them rotating with the shaft. In this method oil under 250 lbs. pressure is forced between these surfaces so that in reality the rotating part revolves on a thin film of oil. It is stated however, that as dependence upon this method alone has proven unsatisfactory at times, due to the fact that on rare occasions the oil supply may fail and before the unit can be stopped revolving the bearing discs may be heated to destruction, the thrust bearing is also provided on the inside with a set of steel rollers which do not require for their lubrication oil under pressure but merely immersion in oil. In this case a housing for a thrust bearing is built oil tight so that at all times these rollers are travelling in a bath of oil, so should the thrust discs fail to receive their oil supply the load will settle down an amount due to the clearance upon the rollers and the entire weight will travel on the rollers until such time as the oil pressure in the first operation may be restored. It is felt by the engineers that the roller bearings may be found so satisfactory as to permit of their continuous use with only the occasional use, in emergencies, of the cast iron bearing pieces.

It will be further observed from Fig. 1 that the thrust bearing rests upon a casting which is conical in shape and that this conical casting finally rests upon a foundation ring which is indicated in the drawing by "the main support connection between wheel superstructure and foundation ring." It will be noticed that this main support connection is a part of the casting H which is the lower ring of the pit lining, described above.

The letters AAA represent the grease cups for the lubrication of the unit. Through these grease cups, together with the general lubricating system, every part of the unit is

capable of perfect lubrication with either grease or oil while the wheel is in motion.

The ordinary turbines of this design and magnitude have a part of their bearings always running in water so that lubrication can only be applied as picked up from the water itself, thus causing large maintenance expenditure in operations. The use of one runner on the main shaft instead of two reduces the cost of operation and maintenance in this respect by one-half and was largely the consideration which decided the engineers in the selection of the single runner type. The main vertical shaft is provided with steady bearings at the point indicated.

Different views of the guide vanes are shown in Figs. 1 and 2. These are 20 in number for each wheel and each vane is operated by an independent shaft S, Fig. 1, and each of these 20 shafts is connected at its top to a rocker ring operated by the crank N. These rocker rings revolve horizontally through a short arc sufficient to open and close the guide vanes and in this way regulate the amount of water flowing onto the buckets. The movement of the rocker ring through its short arc is accomplished by the movement of the piston within the cylinder shown at the left of Fig. 1 which is connected to the rocker ring by an ordinary piston rod. The movement of the piston within the cylinder is controlled by compressed oil admitted and released by the action of a set of valves operated by ordinary flyballs.

In Fig. 3 is shown the completed concrete for unit No. 1 intake and indicates the method used to convey the water from the forebay to the turbine, the intake being divided into four sections of the general plan shown in Fig. 2. Steel gates and racks are of course to be added to complete the intake. As there will be four gates to each unit this means 120 such openings in all. As these will be exactly alike it was decided to make steel concrete forms which could not only be used over and over again, but being very strong and rigid permit more rapid construction.

Removal of Ice

Ice troubles on the Mississippi River have to be guarded against as carefully as in Canadian plants. The intake in this case is guarded by a concrete structure separating the river above from the power house and consists of 25 con-

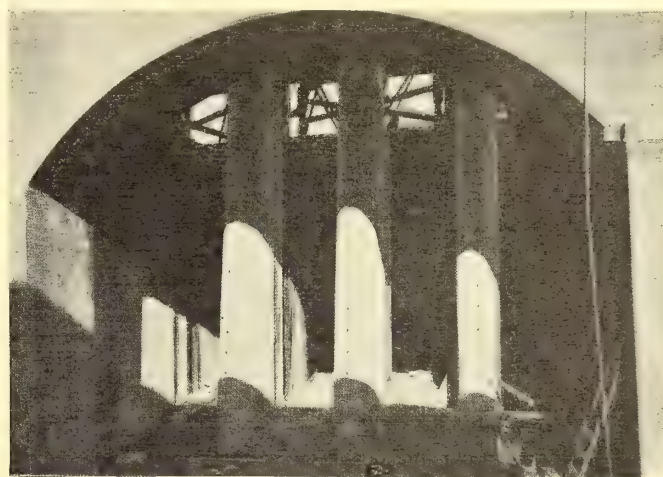


Fig. 3. Completed Concrete at Intake No. 1

crete piers resting on the solid rock spaced 75 ft. from centre to centre. On these piers are placed concrete beams 8 ft. thick, 15 ft. high and 70 ft. long, the bottom of the beams being some distance beneath the water surface. The ice is thus excluded and is forced to go through the piers of the main dam.

Owing to the cost of a large cofferdam shutting off

the river when this ice fender was being built small caissons were constructed within which the concrete for each pier could be placed. Each caisson consisted of four oblong water tight boxes designed in such a manner as to permit of their being locked together when in place and unlocked when they were ready to be taken down and moved. The space between the oblong boxes for each caisson was the exact size of the pier so that when the caisson was sunk into place by means of filling the boxes with water there was no additional form work necessary for placing the concrete. The concrete was then mixed dry

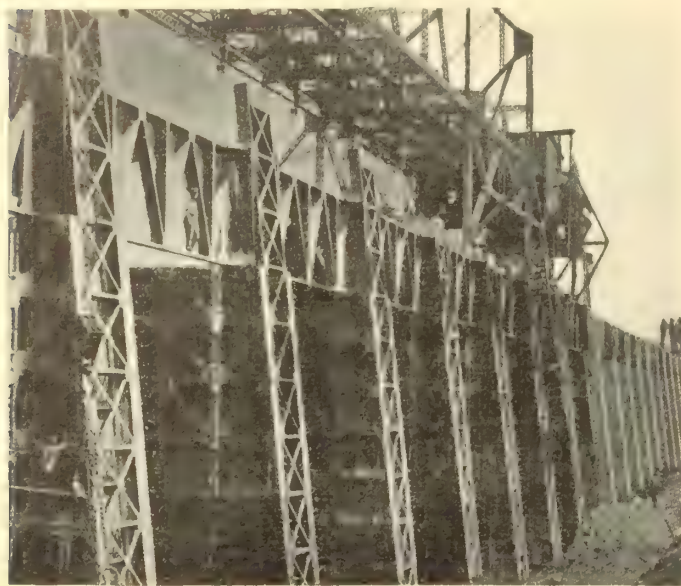


Fig. 4. Steel forms for dam piers not yet removed

and placed by means of a sealed steel box with a bottom dump.

At a point near the shore end of the ice fender there is an opening 300 feet long. During the winter this opening will be closed by means of a wooden boom. In summer the boom will be floated ashore thus permitting the river traffic to pass through undisturbed.

Main Dam

The main dam is being built from the Illinois side of the river and is now almost completed. This work, on account of the extreme length of the dam, had to be done in sections. The cofferdam for enclosing the construction work is made up of two different types. On the up-stream side is a line of timber cribs designed to take the pressure of the water and made water-tight by a packing of earth. On the down-stream side and at the outer end a timber trestle is built from which an earth fill is made acting both as a dam and seal. This procedure was adopted for the two-fold reason of speed and economy in building. The section enclosed by the cofferdam at one time is in the neighborhood of 400 feet in length by 78 feet in width.

The cribs were simply large wooden boxes 8 feet wide and 16 feet long with a 10-ft. space between them. These timber boxes, in order to set firmly on the bed rock were made to conform closely to the contour of the river bed. This was accomplished by taking soundings from a raft at 2-ft. intervals along the line where the crib was to be placed and outlining the contour thus obtained on the 10-in. x 12-in. sills of the crib. When this preliminary work was completed successive layers of 6-in. x 10-in. timber were placed on the sills and the bottom built in the boxes and the whole firmly secured together with drift bolts. This foundation was dropped from the scow upon which it was built and floated to its proper position. Successive storeys were added, fasten-

ed together as before until the whole was brought to the proper height. During the latter process the crib was held in place by means of cables. Last, the stringers which carried the track on the cofferdam were laid and the crib was filled with rock brought forward in cars.

After the cribbage had proceeded some distance the work of closing the openings between the cribs was begun. This was accomplished by means of stop logs forced down across the openings with the ends seated on posts bolted to the sides of the cribs. 3-in. x 10-in. sheeting was then driven down to the rock along the entire face of the cofferdam as tightly as possible. It will be seen that the complete structure was then represented by a tight timber wall on one side and a timber trestle carrying a track down the other side and around the end of the crib.

The water is pumped from this enclosure by two 6-in. centrifugal pumps, each capable of delivering about 1,000 gals. a minute, and when run continuously unwater the entire enclosure in about 70 hours.

At this point of the river there was no deposit of mud or sand existing, so that the bed rock was at once exposed. Large air-operated tripod drills were used to bore holes about four feet apart in lines across the place to be occupied by the dam. These holes were drilled to a depth of about four ft. If any defects in the character of the solid rock bed were shown the work of excavating was carried further, but in any case the minimum depth of four feet was maintained in order that the concrete of the dam should be firmly tied into the rock base of the structure. The width of this 4-ft. channel was 48 feet.

Following the excavation comes the construction of anchor-bolt piers to support the steel forms. These foundations are built in pairs 36 ft. apart along the line of the dam and are simply blocks of concrete 4 ft. by 6 ft. and of varying height into which the anchor bolts are set. Two wooden boxes or forms 43 ft. apart are then built on the site of the pier. A beam across the top supports the two large anchor bolts. These forms are filled with concrete brought



Fig. 5. View of section of dam—downstream side

from the mixing station in buckets and lowered by derricks from the bridge of the dam to a car below. After the concrete is set the forms are removed, the base castings placed over the bolts and wedged up to the exact required height and the steel forms placed. Fig. 4 shows a number of steel forms not yet removed.

In the building of this dam expansion joints are left at intervals of 36 ft. This is accomplished by placing a layer of tar paper at the centre of each pier, against the haunch of each successive arch extending transversely the full width of the bridge, and vertically from the springing line of the arch to the top of the structure. Following the

same general method the ends of the spillway sections are treated likewise. Thus the dam consists of a series of huge masonry blocks, consisting of the pier, arch, and the spillway sections, each separated from the other by the thickness of a sheet of roofing paper.

The spillways which are not yet constructed, with the exception of a small number on the extreme Illinois end of

utilized for country homes and will encourage aquatic sports.

In order that all parts of the work may be in close touch with one another the company has installed a telephone system with necessary switchboard equipment. There are seventy telephones in the system and all parts of the work on both sides of the river and all departments of the main office are thus kept in close connection.

A temporary power house, operated by 44 boilers, with a combined capacity of 3,755 h.p., has been installed to take care of the construction work and to supply illumination for night work if this is required. The cost of the construction equipment altogether has been calculated at \$1,000,000.

The electric generators are being furnished by the General Electric Company, of Schenectady. They will supply 3-phase current at 11,000 volts. Excitation will be by two 1,000 kw. motor-generator sets for operating which current will be secured from a 2,000 kw. a.c. water-driven generator.

The rotors of the generators will operate at 57.7 revolutions per minute which slow speed necessitates a very large diameter. The generators will be 32 feet in diameter by 12 feet high and the total weight of each machine will be approximately 600,000 lbs.

The initial equipment will be in operation, it is said, during the summer of 1913. Power will be used to supply

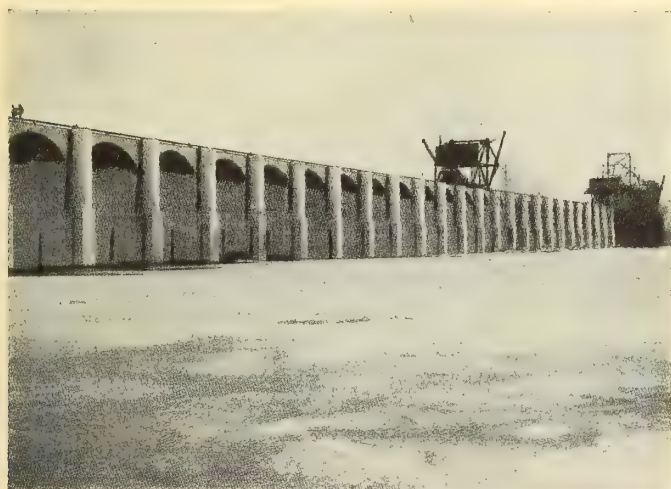


Fig. 6. View of section of dam—up stream side

the dam, will be put in after the piers and arches are all completed. These spillways will not be carried to their full height at once but each will in succession be raised five feet. For those sections which at the time will be covered by water the complete foundation will be unwatered by means of two gates, one of which will close the upstream and the other the down-stream opening, thus forming a box which may be pumped dry for the placing of concrete. After this portion has been carried right across the river raising each of the spillways 5 ft., another lift will be made in the same manner from one end to the other of the dam. Thus the building of the spillways will be done in small lifts to avoid any excessive depths of water to operate

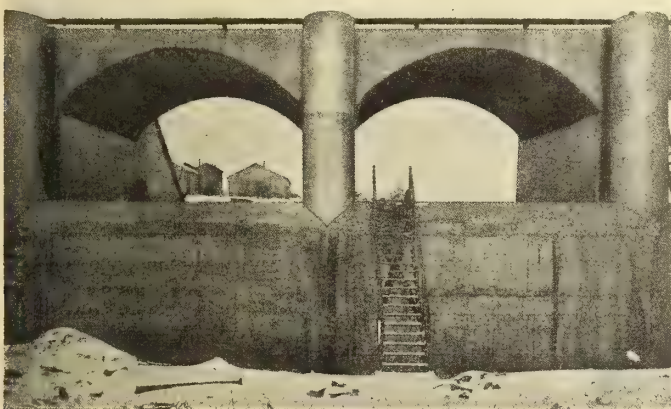


Fig. 7. Pair of completed spillways—up stream side

against and at the same time to permit of the gradual filling of the pond.

The construction and operation of this hydro-electric plant has made necessary the flooding of property over a number of miles north of the dam. A number of towns have been affected and in one case it was necessary to buy about half of the town. As a compensation for this expense, however, a beautiful quiet lake will be formed which will be



Fig. 8. Pair of completed spillways—down stream side

St. Louis, 135 miles distant, and this city is being connected with the development plant by a 110,000 volt transmission line. St. Louis has contracted to use 60,000 h.p. and it is believed that the smaller cities and towns within a range of 100 miles or so of the plant will immediately absorb the remainder of the initial development.

The engineering work is in charge of the Stone & Webster Corporation, under the direct supervision of Mr. Cooper as chief engineer. The work on the two sides of the river is kept entirely separate and under entirely different organizations except that Mr. Cooper is in direct control of both

Experts Appointed

Under the agreement between the Winnipeg Electric Railway Company and the City of Winnipeg for the settlement of the pole dispute, each party has to name an electrical expert for conferring with the Public Utilities Commissioner, Judge Robson. Mr. Kelsch has been selected by the Winnipeg Electric Railway Company as their engineer, and Mr. Richardson of Montreal will represent the city of Winnipeg. They will meet at an early time and settle on a basis for the joint use of poles and conduits.

Modern Industrial Illumination

And the Average Performance of Lighting Systems Discussed Before the Boston Convention of the A.I.E.E.

by C. E. Clewell

Illumination in the past has been looked upon largely as an accessory. Modern illuminating engineering, however, is concerned with the adaptation of the available types of lamps to certain supply circuits, to various classes of service, and to given conditions of building construction.

A few years ago the older type of arc lamp and the carbon filament lamp, typifying a large and a small unit, covered the range of types of lamps available for illumination work in the industries. This limitation in candle-power has gone through an evolution by the introduction in more recent years of the enclosed arc, the open flame-carbon arc, the metallic flame arc and the long burning flame carbon arc lamp, as improvements on the original arc lamp; and the metallized filament, the tantalum and the tungsten lamp, as improvements on the original filament lamp. The Moore tube, the Nernst and the mercury vapor lamps are also available as new types.

Re-directing the light where most useful should be included in development of high efficiency lamps as additional to the matter of total light flux per watt. The growing tendency to rate electric lamps according to the effective illumination produced on the work rather than in terms of the watts per mean spherical candle-power is evidence that this item will probably be included in the considerations of lamp efficiency more in the future than in the past.

Quantity of light is no longer the sole criterion of excellence, but its uniformity over the work, diffusion, adequate intensities on the sides of the work, absence of glare, color values and similar items are now given an importance almost if not quite equal to mere satisfaction in the matter of vertically downward intensities.

Factory work generally speaking may be grouped into work on a horizontal plane, as bench work of some kinds, which, in the main, requires only downward illumination; and other work such as that included under machine tool operations, foundry moulds, rolling mills, assembly, and the like, where, in addition to vertically downward light, side components effective on vertical planes, as well as shadow elimination, play an important part in the excellence of results.

The height of ceiling, roof or trusses, limits, in a very large measure, the size and type of lamp to be employed. Experiment and usage demonstrate the disadvantage of using very large lamps for low ceilings, while lack of economy prohibits the use of small lamps for high areas. In former years arc lamps were used for low factory bays, while in some extremes no appreciable general illumination was possible due to the absence of sufficient clearance between cranes and ceiling for an arc lamp. In like manner very high bays have been inadequately lighted due to the lack of lamps possessing sufficient candle-power and suitable distribution characteristics. To-day, however, lamps of enormously greater candle-power and more suitable distribution are available for the higher areas, while lamps with corresponding advantages are available for low areas.

Open spaces simplify the problem by permitting the use of lamps spaced comparatively far apart, while the interference of belting calls for a type and arrangement of lamps which will provide diffusion, so as to reduce the shadows ordinarily produced by belts. In an atmosphere filled with dust and dirt a penetrating light should be employed, and in spaces of the latter class the maintenance is apt to be great-

ly increased with the rapid accumulation of dirt on the lamps and reflectors.

The arrangement of lamps should not be influenced primarily by the ceiling construction. Plans made up without regard to the ease of installation may sometimes be modified so as to yield equally satisfactory results, however, with a considerable reduction in first cost for installing, by taking into account certain features of the beams or girders.

The spacing distance of lamps is a first consideration. Experiments have shown, for example, that in certain office locations with moderate ceiling heights, a spacing distance not exceeding 7 ft. 6 in. is most advantageous. This results in a uniform illumination on the desks if the proper reflectors are used, and the light from a sufficient number of sources thus secured insures a diffusion of the resulting illumination. The directional features of the light are furthermore far superior to those cases where larger spacing distances are employed.

The spacing also governs the size of lamp to be used. As an illustration, whether one 250-watt or four 60-watt tungsten lamps are to be installed for a given area will be determined largely by the desired directional features of the light.

The mounting height should be determined on a basis of the avoidance of glare and of the ease in getting at the lamps for maintenance. The lamps should be mounted high enough to be out of the line of vision, and where the ceilings are too low to admit this, lamps of small size should be selected to reduce the quantity of light flux which enters the eye or is effective thereon when looking into any lamp.

Efficiency of Utilization

The term efficiency is here used to express the relation between total light flux furnished by the lamps to the work, on the one hand, and the total flux emanating from the lamps of the system in all directions, whether useful or otherwise, on the other hand.

Such a use of the term refers of course to the efficiency of the lamps themselves coupled with surroundings and reflectors in the matter of the useful illumination they furnish to the work. The numerical values expressing this efficiency will thus be less than unity and expressed in per cent. of the ideal condition if the total light flux available were wholly useful on the work.

The need for data on the average performance of illumination systems has been felt for some time. With the view of meeting this need, and also for the purpose of establishing some certainty regarding the various factors involved, extensive tests, have been conducted during the past year, and the results of the same are now herewith presented for the first time in the hope that they may furnish useful information on this important phase of illumination systems, and also serve to further additional work, thus begun in this particular direction.

At the outset a study was made of the items involved in the determination of the average performance, that is, the variation in the illumination intensities furnished by the lamps day in and day out, and a number of typical locations representative of average industrial conditions were selected for the test. These tests were made on the vertically downward (or so-called horizontal) intensities of the illumina-

tion produced by a fairly large number of lamps in each location, thus securing a more general idea of the changing conditions than would likely result from individual tests on single lamps or reflectors. By these tests it has been sought to establish the actual efficiency of the various illumination systems considered, as compared to the theoretical efficiency which might be supposed to exist from calculation based on candle-power distribution curves. Four conditions were chosen as follows: (1) new lamps and reflectors; (2) clean lamps which have been in service for several months, and clean reflectors; (3) clean lamps several months old and soiled reflectors, ready to be washed in the routine of the plant; and (4) soiled lamps and soiled reflectors ready to be cleaned. This series of conditions represents lowering steps in the efficiency of the system, and the results show by how much each of these factors may reduce the total efficiency. It will be apparent that the reduction in efficiency by these three items refer to losses in the system itself. These losses further obviously determine the inherent performance of the system, and great care was required in making these tests to maintain conditions unchanged throughout the tests, that is, under shop conditions, to be sure that the dust and dirt on reflectors was left undisturbed.

Five typical factory locations were selected for this test, which covered seventeen weeks in itself, but which represents a considerably longer period of time in preliminary tests made throughout the past few years leading to the determination of ultimate reductions of light due to dust and dirt. These five locations were equipped with tungsten lamps and glass reflectors. The locations included a regular office in an office building; a long narrow factory office; a low factory space with no walls and very dark ceiling; a medium high factory space with light walls and light ceilings; and a moderately high factory space with dark walls and no ceiling, the lamps being mounted on stringer boards attached to the girders. Observations of voltage were taken and all intensities corrected for the normal lamp voltage. The table shows the results of these tests and the

TEST RESULTS ON TUNGSTEN SYSTEMS WITH GLASS REFLECTORS.

Efficiency values* Conditions of test	Low office	Fairly high factory office	Low factory space	Medium high factory space	Fairly high factory space
Ceiling	Light	Light	Dark	Light	None
Wall	Light	Light	None	Light	Dark
Lamps	60-W. Cl.	60-W. Cl.	100-W. Cl.	100-W. Cl.	100-W. Cl.
Reflectors	I-60 SF.	I-60 Cl.	I-100 Cl.	I-100 Cl.	F-100 Cl.
Class of work	Desk	Desk	Machines	Bench	Bench
Time between washings	14 weeks	17 weeks	9 weeks	11 weeks	13 weeks
Results		Efficiency	in per cent		
Soiled lamps	19.7	24.2	22.4	25	20.1
Soiled reflectors					
Clean lamps	20.7	24.9	22.5	27	23.6
Soiled reflectors					
Clean lamps	34.1	29.3	31.2	35.3	33.6
Clean reflectors					
New lamps	34.1	31.2	31.9	36.1	39.1
Clean reflectors					

*All efficiency values corrected for normal lamp voltage.

attending surrounding circumstances. The value of these constants can hardly be overestimated when considered in the light of their usefulness in the calculation of factory lighting systems, which can thus be based on absolute experience. The foregoing notes apply to the performance of a system as installed and in regular service.

Depreciation Items

In the calculation of illumination systems additional factors must be taken into account, namely, (1) the effect due

to the operation of the lamps at a voltage other than the normal rating, frequently the case in tungsten systems; (2) the depreciation of candle power due to the aging of the lamps; (3) the depreciation due to surroundings which are liable to become dark; and (4) the effect of dust and dirt accumulations.

The losses due to voltage conditions can readily be calculated from the curves showing the variation of candle-power with voltage; the effect of age of the lamps, although somewhat more uncertain, can be determined with a fair degree of accuracy from the life curves of the lamps as made by the lamp manufacturing companies; tests have been conducted, as previously referred to, in the determination of the effect of surroundings on the illumination results. While the tests just described for the determination of practical efficiencies at the beginning and at the end of a cleaning period were difficult in the matter of maintaining conditions unchanged, these same difficulties encountered in this particular test were considerably greater. To insure value, it was deemed essential to perform the tests in factory spaces where the regular manufacturing operations were in progress from day to day. This necessitated constant watchfulness to make sure that the systems were undisturbed in the matter of the dust and dirt accumulations.

Follows Fairly Definite Rate

Under average factory conditions the deterioration of glass reflectors due to dust and dirt follows a fairly definite rate of candle power reduction, in so far as conclusions can be deduced from the number of cases on which these tests were conducted. This reduction is due alone to dirt accumulations on the reflectors, since the new lamps were inserted before each test and all observations were corrected to correspond to normal lamp voltage.

Similar tests showed that, based on the average cleaning cost of three cents per reflector, with energy at two cents per kilowatt-hour, the integrated cost of light lost at the end of sixteen days in one of the cases, is equal to the cost of cleaning. This point (namely sixteen days) would then naturally determine the economical interval for cleaning reflectors in this particular location, provided always that the reduction in intensity at the end of this interval is not below that which is necessary for satisfactory vision. It is of interest to note that apparently the effect of dust and dirt takes place far more rapidly in the first week or ten days than during the succeeding weeks.

Other useful information was deduced from these tests: if, for example, the loss of light at the end of sixteen days equals 25 per cent., which means, for an initial intensity of four foot-candles, that there remain, at the end of sixteen days, only three foot-candles, the average intensity throughout the sixteen day interval may be approximated at three and one-half foot-candles, provided the reflectors are cleaned once every sixteen days. If an additional sixteen days without cleaning means a still further reduction from three to two foot-candles, the average intensity of the illumination throughout the thirty-two days interval may be approximated at three-foot candles. Hence the cleaning of the reflectors at intervals of sixteen instead of thirty-two days should insure an average intensity of say three and one-half instead of three foot-candles, or in other words, to maintain an average intensity of three and one-half foot-candles would require approximately twenty per cent. more lamps in the installation for a thirty-two days than for a sixteen days cleaning interval.

This would mean in an installation of, say, 1,200 tungsten lamps, a saving of 200 lamps in the original installation, or roughly, \$1,000 in a total of \$6,000, the first cost, by the adoption of a sixteen days instead of a thirty-two days cleaning interval. To clean 1,200 reflectors every thirty-two

days involves in practice an expenditure of approximately \$432 per annum, while to clean the smaller number of 1,000 reflectors once per sixteen days involves approximately \$720 per annum, or an increase of say \$288 per annum. The increased cost of cleaning, with shorter cleaning intervals, is, therefore, small in comparison to the reduced first cost, to the lower energy consumption with a smaller number of lamps, and to the improved average service.

Maintenance

From the foregoing statements the necessity for careful and systematic maintenance will at once be apparent. In one large system of 10,000 tungsten lamps, the losses of light per day due to dust and dirt interpreted into money values, that is to say, evaluating the energy in watts represented by light wasted through absorption by the dirt, to its kilowatt-hour cost, amounts approximately to \$20 per day, or \$7,500 per annum. If the systems are allowed to go uncleaned beyond the economical point, these losses become aggravated. The expenditure of an amount like the foregoing, for energy which represents no return, serves to indicate in a startling manner the significance of adequate maintenance.

This illustration and the ones previously mentioned in connection with deterioration have been based on tungsten systems, but the results will show what may be expected in lighting systems of other types of lamps from the accumulation of dust and dirt, and it is hoped that these tests and statements will be but forerunners of additional data along these and familiar lines in the near future.

Relation of Wages to Illumination

Figures were also prepared to give an idea of the re-

lation of average wage conditions and lighting costs. The values were taken from actual average cases and show in a graphical manner the small percentages of the total wages represented by the average lighting costs. The fact is shown that the wages for six minutes per day in average shops, pays not only for meagre, but also for entirely adequate illumination, and when one considers that nearly all shops have some lighting facilities, poor as they may be, the difference between poor and excellent lighting in its relations to improved surroundings and better workmanship is apparent.

In one large shop where extensive installations of high efficiency lamps have been under way for nearly three years, a summary shows an increase of nearly 30 per cent. in actual candle power for a 5 per cent. increase in total operating and maintenance costs. This increase of 30 per cent. in candle power in no way, however, indicates the enormous improvements in the matter of excellence in distribution and refinement of results; it merely shows what great advances have been made in the possibilities of industrial illumination by the newer types of lamps. Added to this candle power increase there are, of course, many advantages which have been brought about by the careful and scientific adaptation of the lamps best suited to each condition.

It will be impracticable to indicate in a definite manner the extent of present activity in terms of exact installations, but it is of interest and significance to note the progress which is being made in the growing intelligence among factory owners regarding the proper illumination for their plants. The work of the past few years along this line, if taken as an indication of what may be expected, promises great advances in the immediate future.

Electricity in Agricultural Pursuits

Public Opinion Aroused—Many of the Larger Farms Already Equipped—Especially Valuable in Irrigation Work*

by Putnam A. Bates

Never in the history of this country has there been such a great arousing of public opinion, such an arousing of interest of the people generally, in the agriculture of the country. We are commencing to appreciate that while in the early years of the past century two-thirds of our people were engaged in the producing business, producing food and clothing for the people, now but one-third are so engaged. And it also seems to be pretty clearly demonstrated that the average earning of the average farmer has netted too small a return for his labor. In many parts of the country, what he did earn was earned at too great a personal sacrifice—labor for long hours and no recreation. Plainly speaking, we have wakened up to the situation that though the yearly crop figures seem to indicate an abundance, we are actually approaching the condition where demand will soon exceed supply, and in most instances the farming business is badly out of gear and needs reorganizing. It has fallen to the lot of the electrical engineer to take a hand in many matters of reorganization, and I believe agriculture now requires his attention.

Betterment of the farmer's conditions and improved efficiency in all the operations involved in his work is the cry of the day. Bankers and business men's associations, federal departments, agricultural colleges and important engineering organizations are giving this feature of the country's welfare careful study, and yet there is perhaps no one improvement that may be counted upon to so radically bene-

fit the farmer as the introduction of electricity on the farm.

The electric farm, however, is not a new idea, for several farms well worthy of this name have been in successful operation for some ten or twelve years, and perhaps longer than this. But there has been very little organized effort in disseminating existing knowledge of the practical use of electricity in agriculture, with the result that farms so equipped are generally regarded with suspicion and possibly in the light of a hobby.

I shall endeavor to show that such a point of view may at once be dismissed and we may look for a general use of electricity on the better class of farms in this country before many more years have elapsed. As a matter of fact, electricity is now being utilized for lighting and power purposes on a much larger number of American farms than perhaps many of us have heretofore realized.

Let us consider for a moment the farms of our great Southwest. In some sections of that wonderfully fertile country, well protected by the high mountain ranges, practically every farm is an electric farm. That is to say, the buildings are lighted by electricity and many of the laborious operations are accomplished by the use of electric power. These really were our first electric farms, the period of their establishment corresponding with the development of the water powers of the nearby mountains.

On the majority of these farms irrigation is practised and quite naturally electricity was first made use of for pumping purposes. Then under the influence of progressive

*Presented at A.I.E.E. Boston Convention.

local central station operators, it was almost universally adopted for light.

I can recall seeing electric lights and the electric flat iron in use in the farm homes on the Pacific Coast, eleven years ago. The people were content to enjoy the advantages which these improvements made possible to them, but did not seem to regard their conditions as unusual. Their farms were in fact electric farms and their industries dependent upon the product of the land were, as they are now, practically all operated by electricity. I refer to the canneries, fruit packing houses, etc.

The conditions surrounding the farming districts in Southern California, for example, at that time, were such that any other form of energy would have been unusual to adopt, a combination of circumstances being largely responsible for this happy situation. The high-tension transmission service systems were then new and the companies desired business; besides this, we did not have the gas engines we have to-day. The efficient and reliable gasoline and fuel oil motors were not developed until several years later. There was pumping to do, for irrigation was rapidly coming into favor, and, naturally, the electric companies secured this business.

It is hard to say whether the power plants, supplying service at rates within the reach of all, made the irrigated farms, or the electrical load, which these farms offered, insured the success of the power developments. Both interests seem to have worked together and in some instances practically the entire supply of the central station current was at once engaged for lighting, heating and power uses on the farms. This was the case ten years ago in the instances I speak of, and according to reports I have just received, the situation has not materially changed, except that both supply of and demand for the current have increased.

Such electric service plants may be regarded as "farmers'" central stations and I shall commence my illustrations with a description of the Mount Whitney Power and Electric Company's service in the vicinity of Visalia, Cal. This will serve as an illustration of a plant of this class. The territory covered by the service of this company is typical of a modern intensive farming district where irrigation plays an important role.

Some of the farms in this district are large farms of several hundred acres, but the majority are small truck and fruit farms, ranging from 10 to 40 acres, an average of about 20 acres to each person, the total number of acres irrigated by electric power from the Mt. Whitney plant approximating 25,000, and representing about 6,000 horse power in electric motors.

The writer has in mind a characteristic pumping installation employed on the irrigation farms in this district. It is interesting to note that on this 800-acre farm the electric service lines have been carried to several widely separated points, serving pumping motors in some cases of no greater capacity than five horse power. In fact, the loads these western central stations cater to, oftentimes, are of surprisingly small amount and quite distributed. In the Exeter district, where this 800-acre farm is located, there are 32 plunger pumps aggregating 96 h.p., and 16 centrifugal pumps aggregating 125½ h.p. And in the Lindsay district, comprising about 25 square miles, there are in operation 217 pumping plants with a total connected horse power of 1,794, of which 113 were plunger pumps (1,100 h.p.) and 104 centrifugal pumps (694 h.p.). The total pumping load connected to the company's system is 374 plunger pumps (2,385 h.p.), and 256 centrifugal pumps, (2,471 h.p.) or a total of 630 pumping plants with 4,856 h.p., being on the average 7.7 h.p. for each pumping plant.

The Cost of Power

The irrigation pumping season in California is from five

to six months at 24 hours per day. Contracts are on a basis of \$50 per annum per horse power; the customer installing and maintaining at his own cost the motors, transformers, pumps, housings and all other appliances. He agrees to pay each year the sum of \$50 for each horse power furnished him at time of his maximum consumption during the year. He further agrees that the amount of power to be paid for at that rate shall not be less than 75 per cent. of the rated horse power of the motor. Motors of less than five h.p. are paid for at \$50 per year for the rated horse power of the motor, instead of 75 per cent. thereof.

In very few cases only, power is sold between the hours of sunrise and sunset at \$30 per h.p. per annum, the company not having much power to sell at this rate as, during the irrigation season, the irrigators want to operate day and night. However, small power applications are taken care of in this way, consisting chiefly of cream separators, churns, grindstones, wood saws, heating flat irons, washing machines, fans and other domestic items.

There is also a partial meter rate contract which is used principally by growers of acidulous fruits and alfalfa, the essential points of which are as follows:

Current is furnished during the six months, February 1st to August 1st, at \$25 for each horse power based on maximum demand, while for current furnished during the remaining months of the year, the rate is three cents per kilowatt hour, it being agreed that the maximum amount of power to be used during the meter period will be equivalent to at least \$6 per horse power per month for motor rating.

The straight motor rate is used for development work, grading from five cents for the first 26 kilowatt-hours per month (additions depending on size of the motor and the months), usually ranging around one and three-fourths cents to two cents per kilowatt-hour per month. Most of the irrigating power, however, is sold on the \$50 flat rate.

Electrically Irrigated Farms

The farms served by the Mt. Whitney system may be termed electrically irrigated farms, as in all cases the farmer operates his irrigation pumps by electricity. The details of this class of business it will be seen are well established. Electric companies in other sections have also built up businesses of this kind and in doing so have followed the same lines or a modification of them.

Another hydro-electric development and distribution system where irrigation pumping forms an important portion of the total load is that of the Pacific Power & Light Co.

The lines of this company traverse a fertile farming district lying in the southeastern corner of the State of Washington, just east of the Cascade Mountains. Several power developments are connected together, making a complete distribution system, serving a total population of 101,900, including 39 towns, having an average population of 2,500. In addition to the towns, the population of the rural communities is 5,000.

There are 300 miles of primary lines at 66,000 volts, with 500 miles of 6600-volt secondary.

All of the plants making up this company's system are illustrations of a generating station designed to meet the lighting and power demands of a growing farming community. The energy of the falling waters is utilized first for generating electricity and then allowed to pass on, to be used again for irrigation. The magnificent orchards and gardens which have thus been made possible on the waste places of the earth are wonderful accomplishments of which we may well be proud. There can be no greater work for us all in this day of agricultural investigation, than to advance in all parts of our land the utilization of our resources as exemplified by these illustrations.

During the early part of the history of American farm-

ing there was too much extensive husbandry and not enough intensive farming. Land was abundant and cheap, and much of it drained itself. The pioneer, believing the supply of land inexhaustible, selected a patch, killed off the trees, cultivated it until the fertility of the soil was exhausted, and then moved to another location. In this way, the increase in population being enormous, great and rapid inroads were made on the country's natural resources of soil. In time, all the naturally drained and naturally watered lands became absorbed, and a great deal of it exhausted, temporarily at least.

The reclamation of our western desert and prairie land along most approved scientific lines is an object lesson to us all. Those lands are now rapidly being taken up and have become very valuable, and fertile low cost farms by the tens of thousands are needed.

We have learned from these western developments that for proper crop culture all lands must be drained and all crops need water. And it is not sufficient to have a deluge of water from time to time, but water must be applied in such manner as to provide the food necessary to plant life, in order that development may be greater at certain stages of its growth. This is especially interesting, in that it is a claim for the merits of irrigation, not only in the arid country, but also in sections where there may be an abundant rain fall.

Mr. C. J. Blanchard, Statistician of the United States Reclamation Service, in a lecture on "Making the Wilderness Blossom," states that the desert of our old geographies has no place on the map. The magic of irrigation has transformed valleys long vacant into prosperous agricultural communities.

A brief summation of the work accomplished shows that construction is under way or has been completed on 29 projects involving an expenditure of \$65,470,000. In the eight years of actual work there have been dug 7,000 miles of canals and more than 19 miles of tunnels, mostly excavated through mountains. The total excavation of rock and earth amounts to 77,200,000 cubic yards. There have been built 570 miles of roads, 1,700 miles of telephones, and there are now in operation 275 miles of transmission lines over which surplus power and light are furnished to several cities and towns. The small farms and villages grouped about these developments give the effect of suburban rather than rural conditions. The cheap power developed from the great dams or from numerous drops in the main canals is now utilized for the operation of trolley lines which reach out into the rural districts bringing the farmer in close touch with the city. It runs numerous industrial plants, for storing, handling and manufacturing the raw products of the farm. The same power is used for lighting and heating in the towns and for cooking in the homes. On several of the projects the farmers are applying for electric power and in many farm houses electric power is utilized for many domestic duties.

A Powerful Combination

Thus it may be seen that scientific agriculture, irrigation and electricity have formed a powerful combination. The natural waters are played with at will, sometimes passing directly to the land, but more often the turbulent mountain streams are carried for miles in flumes or canals, only to give up energy at several points on the way, and ultimately to irrigate the land by gravity, or pumping, as the conditions may require.

Another method is to drain the marsh land and pump the water thus available on to the higher places adjoining. Suitable crops are then grown on land of any level with the result that the area for production is materially increased.

In many of our states, both east and west, there is a well established underflow of water which can be made avail-

able through pumping. In the sections where irrigation methods obtain, water ditches conveying this well water to various portions of the farmer's land are often carried to the next man's land, the compensation thus derived diminishing the pumping cost.

All through our western and southwestern country are to be found examples of well installations where electric power has replaced steam or gasoline engines, for it becomes economy to do this under the favorable rate charged by the electric generating stations there. Irrigation is the key which unlocks the fertility of the soil, and to comprehend its importance in agriculture, one must appreciate the fundamental principles governing plant growth and soil culture.

Rain may or may not come when it is needed most, and again, it may pour forth even in destructive quantities, but water under a well-managed irrigation system is turned on when and where required. This makes farming in so-called arid land a more definite and scientific proposition than it is in parts of the country apparently more favored by nature. When we have so arranged our soil conditions that water may be drained off the land as positively as it is applied, the application of irrigation methods are beneficial, no matter what may be the natural conditions of rain fall.

Pump irrigation results in intensive farming. And this is the direction in which our agriculture is moving. It may also be added that the power required for pumping has proved to be the opening wedge in introducing the use of electricity in the majority of those farming districts where dependence upon this form of energy has become established. The most scientific farming can be done only by pump irrigation where the work can be arranged and the farm run just as systematically as some of the big manufacturing and commercial undertakings.

Electricity on Dairy Farms

Electricity is gaining a foothold for both lighting and power in our better class of dairy farms. Its great cleanliness and safety for lighting leave little room for argument where new dairy buildings are being planned. And on account of its convenience as a form of power, it is frequently used with cream separators, churns, refrigerating machines, milk testers, also in the barn or field work incidental to the preparation of feed and handling of crops.

On a typical large milk farm in New Jersey electricity is used for lighting, clipping cows, operating a bottling machine, spinning on tinfoil caps or seals on bottles, cutting ensilage, running a sawmill, pumping water from a deep well, grinding feed and elevating it to storage bins. The fact that this is a commercial plant turning out daily from 3,500 to 4,000 quarts of milk, where a high standard of quality is rigidly maintained, is evidence that there must be advantages in using electricity in such an installation. The total acreage of the farm is nearly 1,200, and at present about 70 per cent. is under cultivation. Electricity is generated by steam power and distributed at 220 volts. The generating equipment consists of one 25 kw. direct-connected unit, steam boiler, etc. This is not a large generating plant, to be sure, but it insures cleanliness of lighting equipment and safety from fire risk in the barns, bunk houses and outbuildings. It also makes possible a convenient source of power in any part of the farms or outbuildings, which, of necessity, are widely distributed, and cost of generating the current, including interest and depreciation charges, is probably not over four cents per kilowatt hour. Scientific milk production is more and more coming into prominence and the necessity for perfect cleanliness, immediate cooling and keeping the milk at a low temperature, compels such dairy farmers to adopt devices that will be most helpful in obtaining these results.

"Dairying" and "stock raising" are usually followed

where land needs up-building in fertility, and in either the silo is a necessity, cutting up succulent forage crops and storing them in the silo for later use being the accepted method of preparing the feed. To do this the farmer must have power, but a 10-h.p. electric motor with its capacity for momentary overload will do work that would stall a gasoline engine rated at 12 or 15 h.p. Hence, for silage cutting and elevating, a 10-h.p. electric motor is sufficient where a 20-h.p. gasoline engine would be recommended. The farmer can easily recognize the advantage of the electric motor for this operation, and when once adopted, he soon wants to use the current for grinding feed, baling hay and other purposes.

On the dairy farm, however, electricity offers other opportunities, as it is the most convenient form of energy for operating an artificial refrigeration plant, the cream separator, churn and butter worker. The reason for this rests in the ease of control, making for economy. The current is used only while the apparatus driven is in operation and may be shut off when the work is done. No skill whatever is required to operate such equipments, it being necessary only to turn a switch.

Operating Cost Small

Cream separators, while often turned by hand on small dairy farms, are more frequently driven mechanically where considerable cream is handled. Cream separators, except in the very large sizes, require not more than a 1/5 h.p. motor, and they are in operation only for a comparatively short time. The operating cost, therefore, is practically negligible.

In large dairies where hand milkers are difficult to obtain, the milking machine has a place and the records seem to show that these devices are favorably received in some of our western dairy sections at least. Those that the writer is familiar with which have been commercially used in this country consist principally of a vacuum pump, milk chamber with specially constructed admission valves, rubber connecting tubes and special type of cups which fit directly on the cow's teats, a convenient method of driving the vacuum pump being by the electric motor. These equipments are often called "electric milkers."

A milking device known favorably to the writer is so designed that an electric motor of about 1/12 h.p. forms an integral part of the apparatus that does the milking, the whole machine being suspended under the belly of the cow. Through a worm and gear the motor moves an aluminum rod forward and backward, which carries the pressure plates, and the teats, being held in a fixed position by a corresponding set of stationary plates, are thus squeezed as in hand milking. It is an ingenious device, free from springs, tubes or other parts which might get out of order, and being of aluminum it is very light in weight. All of the details of design have been carefully developed, and as a machine milker, it is deserving of careful consideration.

That electricity on the farm makes for great economy, not only through convenience, cleanliness and safety, but also in actual cost of operation, can be proved over and over again in the case of those installations where the service is properly installed and where apparatus of suitable type and size has been selected. For example, in one instance where the monthly output was considerable, the cost for electric power averaged from one-half to one and one-half mills per pound of butter made, the rate of charge for current being 2½ cents per kilowatt hour.

Considering the cleanliness, minimum upkeep and labor required, this cost becomes negligible. And the difference in cost of using electric illumination, compared with the full costs incidental to burning kerosene, while somewhat dependent upon the relative rates of charge, is actually in

favor of electricity, when chimneys, wicks and time of trimming are considered.

Can Generate Own Power

It may, therefore, be accepted as a fact that on the farm, as elsewhere, electricity for lighting and power results in lower cost, but to make this statement so that it cannot be disputed, I would add that where electric service cannot be obtained from a public supply on a basis that will insure reasonable rates, it is entirely within the privilege of the farmer or rural dweller to equip his property with a private electric generating plant that will give him light and power at moderate cost, and the operation of such a plant should not be difficult for anyone to understand.

The plant known to the writer embodies a maximum of simplicity and minimum of operating expense, for which reasons I refer to it as an equipment within the reach of anyone desiring the benefit of electricity with very moderate outlay. In this instance, a small dynamo (6 amperes, 35 volts at 450 rev. per min.) is belted to the vertical shaft of a wind mill. As the mill speed is not constant, an automatic cut-in is introduced in the electrical circuit between the dynamo and the storage battery, from which the lighting current is taken, the charging of this battery being the sole duty of the dynamo.

This plant develops current for 24 15-watt, 25-volt tungsten lamps. Its whole cost was \$250, exclusive of transportation, but including windmill, dynamo, storage battery, automatic cut-in, wire, porcelain insulators, sockets, switches and tungsten lamps. The owner did the complete wiring and arranging of the lights and switches. The two years of successful operation and the cleverness of the lighting scheme, which embodies several two-way and three-way switches for distant control of both exterior and interior lights, is certainly an indication that this farmer who runs a farm of some hundred or more acres, has done for himself what many other farmers may also do by a little planning and some interesting labor.

Entirely Practical

In conclusion I would state that the practicability and feasibility of utilizing electricity for both lighting and power on the farm has been demonstrated by many successful installations. In some agricultural sections, central station operators are stimulating a general use of electricity in rural districts by following a far-sighted policy as to extension of service lines and rates for current. Should one or more isolated farmers find it impracticable to obtain central station service, there is open the opportunity of establishing a co-operating generating station, utilizing waterpower, producer gas, steam, gasoline or fuel oil equipments, depending upon the conditions obtaining. In conjunction with such co-operative electric generating stations, there could be operated community laundries, creameries, canneries, grist mills or other industries suggested by local needs. Where neither public service nor co-operative plants are feasible, a farmer may, at a cost of approximately \$250, install a private electric lighting plant, large enough for two dozen lights, and from this as a probable minimum, he may install an isolated plant at additional outlay that will provide current for as many lamps and as much power as he may desire.

And, finally, as our future land improvement will involve drainage and irrigation, we may expect to see here, electricity taking a leading place in agricultural development. It should be remembered, too, that electric energy is greatly cheaper than man or horse power, and that nowhere else are man and horse labor wasted through periods of inactivity to an extent to be compared with the labor waste on the farm. Now, when it seems impossible to secure men on the farm, the turn of a switch brings electric energy, begetting production and wealth.

Industrial Progress and Trade Notes

Class E Stoker.—Bulletin B-1 issued by the American Stoker Co., 11 Broadway, New York City. This bulletin will be of interest to all consumers of coal for industrial purposes.

Macbeth-Evans.—Booklet No. 53, issued by the Macbeth-Evans Glass Company, of Pittsburgh, illustrates and describes the lighting of Atlantic City Boardwalk with ornamental standards and Alba globes.

Barnes' Suction Cleaners.—Pamphlet issued by the Advance Manufacturing Company, of Hastings, Mich, from their Canadian Office, 14 King street east, Toronto, descriptive of a light weight, electric, suction cleaner.

Westinghouse Equipment.—The Westinghouse Electric & Manufacturing Company have issued leaflet 3505, descriptive of motor-driven jords in pulp mill service; leaflet 2494 on synchronous booster rotary converters; leaflet 2409 on type QM commutating-pole D.C. motors.

Kerr Turbine Co.—Bulletin No. 26, illustrating and describing the Economy Steam Turbine, has just been issued by the Kerr Turbine Co., Wellsville, N.Y. Photographs of actual installations are shown, interesting steam consumption curves are given and size comparisons are made.

Gem Lamps.—The Engineering Department of the National Electric Lamp Association, Cleveland, Ohio, has recently issued Bulletin 3B, which covers the description and performance of gem metallized filament lamps with data on the cost of producing light with them.

Pass & Seymour have issued catalogue No. 20 from their Solvay, N.Y., office. This catalogue is particularly complete, especially with reference to their new line of Shurlok sockets and their line of outlet box receptacles and rosettes. An outlet box receptacle or rosette has been provided to meet practically every condition that might arise.

Household appliances.—The Canada General Electric Company have issued a pamphlet descriptive of toasters, water heaters, domestic ranges, etc., of the most modern type and efficiency. Also booklet entitled "Cheerful Glow," descriptive of luminous electric radiators; also conduit talk series 2, No. 12, descriptive of various forms of type S conduit.

Copper Clad Steel.—Catalogue issued by the Duplex Metals Company, Chester, Pennsylvania, containing a full description of the process, application and uses of copper clad steel wire as manufactured by this company. The catalogue will be of special interest in the railroad, telephone and electric railway field.

Solid Bitumen Cables.—The W. T. Glover & Company, Limited, Manchester, Eng., have issued a pamphlet covering their "Cracore" solid bitumen cables. In these cables the cores are laid on a central cradle of bitumen compound shaped to a suitable section to receive them. In this way the mechanical pressure between the cores, instead of being concentrated along the line of contact, is well distributed over the surface of this central cradle.

Elevator motors.—Bulletin No. 1091 by the Ideal Electric & Manufacturing Co. of Mansfield, Ohio, describing direct and alternating current elevator motors of all types. The bulletin points out the superiority of electrically operated elevators over other types as to cost, maintenance, ease and safety in operation, etc., and emphasizes the special adaptability of the Ideal motors for elevator work.

Switch Board Meters.—Special publication 1524 by the Westinghouse Electric & Manufacturing Co. dealing with switch board indicating meters. The publication is divided into four sections, treating in succession, 1st, Modern tendencies in design; 2nd, Advantages of induction meters; 3rd, Westinghouse high grade meters; 4th, Theory of induction meters.

C. G. E. Products.—Leaflet B-3192, describing Giant strain insulators as to their mechanical strength, electrical strength, and durability; the insulators are illustrated and results of tests with costs for various sizes given. The same company have issued Condulet Talk, series 2, No. 11, descriptive of various types of Z conduit for snap switch and fused cut-outs; also pamphlet entitled New Pendent Switch, manufactured by the Hart & Hegeman Manufacturing Company for which C. G. E. are agents.

The Burke Commutator Slotting Tool

The importance of slotting commutators is now pretty universally recognized by both mechanical and electrical engineers, and manufacturers of electrical machinery, as being essential to good operating results. The slotting commutator has been adopted by railway companies especially, and the practice has recently been successfully used in large steel mills and industrial plants. It is safe to say that it will soon be adopted by the vast majority of users of direct current motors and generators.

The probable reason that more universal advantage has not been taken of the benefits obtained from slotting commutators is that the machinery has been expensive and to a considerable extent inefficient. The Railway Industrial Engineering Co., of Pittsburgh have recently adopted and are offering for sale at a reasonable cost the Burke commutator slotting tool which is designed to uniformly cut out portions of the mica segments employed in the commutators of electric dynamos and motors. It consists of three parts, a handle, a tubular shaft and a driving motor.

The Handle.—This is by far the most important part of the tool, and contains the essential features. It is made up of five parts and weighs three pounds. Means are provided whereby a saw can be replaced in less than a minute. With this design of handle any sized commutator can be slotted to any depth up to 3/22 in.

The Tubular Shaft.—Experience has shown that the best method of operating this tool is by a semi-flexible tubular shaft and not by a flexible shaft as would be supposed. The reason for this is that in order to get a flexible shaft of sufficient strength to withstand the hard use to which it would be put, the size and weight of the shaft would be prohibited. Small shafts have been tried, but it was found that they would not stand the strain. It was therefore necessary to develop a shaft. This has been worked out, and the shaft furnished with this tool consists of a 3 foot length of steel tubing, on each end of which is fitted a universal joint of special design. The motor and handle attach to this shaft by means of hexagonal couplings. The shaft complete as above described weighs less than one pound, and is capable of transmitting continuously 1/2 h.p. at 1000 revolutions.

Driving Motor.—This may consist of any electric motor, either A.C. or D.C., operating at any speed between 500 and 1200 r.p.m. The capacity of this motor should not be less than 1/8 h.p.

Power-Factor Meters

A poor power-factor can often be improved by a better proportioning of the motors to their load, the use of a super-excited synchronous motor or similar means, with resulting increased capacity and efficiency of the system. It is therefore important, particularly in heavily loaded plants, to know what the actual power-factor is at various conditions of load. To do this, it is not necessary, as it once was, to take readings of voltage, current and power and to calculate from these the ratio of true to apparent watts, as the introduction of direct reading power-factor meters has made calculation unnecessary and enables the determination of the power-factor without trouble. Their use indicates whether induction motors on a system or on any circuit of a system are being properly operated, and enables the adjustment of the exciting current of synchronous apparatus to values giving the most economical power-factor, also indicating a reversal of power if it occurs.

On polyphase systems supplying a mixed load, power-factor indicators are a necessity, as the calculation of power-factor from other meters is complicated and difficult. A

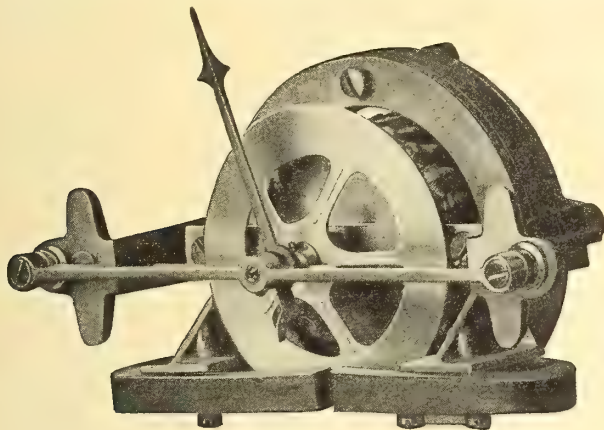


Fig. 1

polyphase power-factor meter having current connection in each phase of the circuit will indicate the average power-factor of all the phases.

The illustrations shown herewith represent direct reading power-factor meters manufactured by the Westinghouse Electric & Manufacturing Company. These meters indicate on a graduated scale the power-factor in the circuit to which they are connected. These power-factor meters operate on the rotating field principle. A rotating field is produced by the current of the metered circuit passing through angularly placed coils. In this rotating field is situated a pivoted iron vane or armature, magnetized by a coil whose current is in phase with the voltage of one phase of the circuit. As the iron vane is attracted or repelled by the rotating field of the current coils, it will take up a position where the zero of the rotating field occurs at the same instant as the zero of its own field. Thus its position will always indicate the phase angle between the voltage and current of the circuit. The pointer attached to the armature, therefore, indicates this angle, and, by marking on the scale the cosine of the angle shown by the graduation, the power-factor is read directly. In the three phase meter the rotating field is produced by three current coils spaced 60 degrees apart; in the two phase meter, by two current coils spaced 90 degrees; in the single phase meter, the position of voltage and current coils is interchanged and the rotating field is produced by means of a split phase winding.

Fig. 1 illustrates the movement of a seven-inch power-factor meter. The winding shown within the iron ring is the stationary winding of the current coils. Inside this,

and not shown, are the stationary voltage winding and the pivoted armature. The laminated iron ring surrounding the winding is provided as a return circuit for the flux of the pivoted armature, so that the reluctance of the armature magnetic circuit is low and uniform in all positions. These parts are shown in the diagrammatic cross-section, Fig. 2.

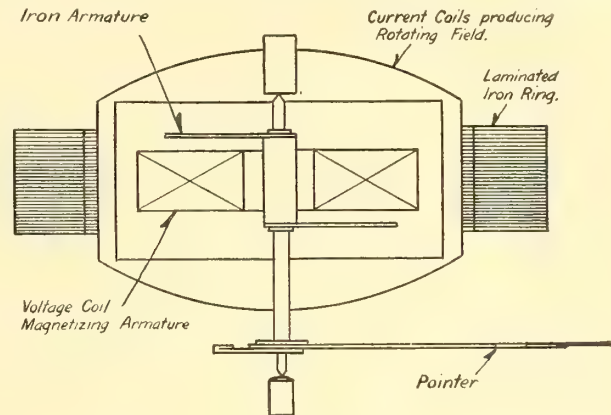


Fig. 2

The aluminum disk shown in Fig. 1 at the front of the meter is a damping disk moving in the concentrated field of the two permanent magnets at the bottom of the mechanism. These magnets and disk have no effect whatever on the electrical operation of the meter. They serve to absolutely prevent oscillations of the pointer, and thus make the readings "dead-beat." The pointer, therefore, does not swing back and forth but comes to rest at once at its correct position. More efficient damping is obtained with this electro-magnetic device than is possible with air damping devices unless a delicate and easily deranged adjustment is resorted to.

It will be noted that in this form of power-factor meter no connection is required between the fixed and the moving elements, nor is any control spring necessary as the controlling force is electro-magnetic. The moving element is, therefore, very light, and the friction and bearing jewel wear a minimum.

All the Westinghouse switchboard types and the poly-phase portable types are arranged to read lagging or leading power-factor on the upper half of the scale, and for

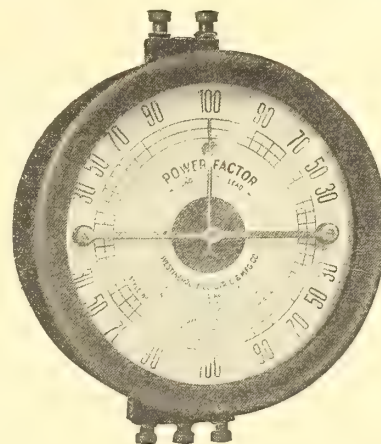


Fig. 3

reversed power on the lower half, Fig. 3. The switchboard types are adjusted for one standard frequency; the poly-phase portables are adjusted to any frequency between 35 and 60 cycles. The single phase portables indicate for 60 cycles on one half the scale and for 25 cycles on the other half. The portable meters are very convenient for investigating the power-factor of motor loads and assist very materially in improving the operation of the system.

A New Auger for Telephone and Electric Light Companies



A valuable tool for telephone, telegraph, electric light, railway and water companies is the Standard Earth Auger, recently put on the Canadian market by the Canadian Logging Tool Company of Sault Ste. Marie, Ont. The expansion blade of the Standard Earth Auger is an exclusive feature possessed, it is claimed, by no other auger made. This ingenious device makes it possible to quickly adjust the boring diameter of the auger so that different sized holes can be bored with the same auger. The No. 10 auger shown in the illustration will bore nine different sized holes from 8 to 16 inches in diameter—or just like nine augers in one. It will go through any kind of soil, hard or soft. With its telescopic stem collapsed it bores holes 3½ ft. deep. By simply releasing the blunt screw and extending stem it is instantly adjusted to bore holes 8 feet deep. Extensions to the handle can be made to bore wells to any depth.

Photogravures of Eye Comfort Installations

The National X-ray Reflector Co. are distributing a set of thirty 6-in. x 9-in. photogravures showing installations of the Eye Comfort System in various types of interiors. Each picture shows a prominent installation. On the back of each is printed the engineering data applying to this installation and a brief description as to the adaptability of this system to the lighting of this particular type of interior. Where these sets have already been distributed they have been pronounced valuable aids to salesmen interested in the Eye Comfort System. They are punched ready to insert in the green binder along with the other bulletins of this company.

A dozen sketch illustrations of new stock Eye Comfort fixtures are also being distributed, also two photogravures showing interior equipment of shallow bowl and deep bowl Eye Comfort fixtures. These illustrations show clearly how the reflectors are held in just the right position with regard to the lamps, ceiling and area to be lighted. A pamphlet by the same firm on "good lighting" gives figures and facts of value to those who are asking the question of how much it costs to install the Eye Comfort System and how the cost compares with direct lighting installations?

Canadian Tungsten Notes

Electrical men attending the Toronto Fair should not fail to visit the Canadian Tungsten Lamp Company's exhibit in the Manufacturers' building. These people have an artistic stall with a very complete line of their various products.

Messrs. T. McAvity & Sons are agents of this company for St. John, N.B., city and district.

Mr. W. F. Kelly has returned from his holidays and is taking up his territory with renewed zest. He was in Toronto and London and reports successful business.

Mr. F. W. Hollingsworth expects to be in Vancouver some little time, having completed his trip through eastern British Columbia. He secured quite a few very large orders, and anticipates securing his share of business in Vancouver.

P. & S. Equipment

Fig. 1, shown herewith, illustrates a Pass & Seymour brass shell socket with ¾-in. cap made for the large base 500 watt lamps; socket is also made with ½-inch cap. The shade holder is rigidly and permanently attached to the shell. The cap and shell are of substantial brass and threaded with a fine thread. There is a set screw provided on the cap so that the lower shell cannot back out of place. The centre spring contact is of phosphor-bronze. The fibre may be



Fig. 2



Fig. 2

readily removed for the purpose of refurnishing the shell. This device can be supplied either with or without the Shurlok locking attachment. Cut No. 2 illustrates an outlet box receptacle designed for use with large base 500 watt lamps complete with the shade holder rigidly attached. Receptacle sets down into the outlet box and the contact terminals are arranged so that they may be used without cutting the wire. It is thus an easy matter to loop the conductor up whether a single or twin conductor is used.

Northern Electric Notes

Messrs. Pike and Doherty of the Northern Electric & Manufacturing Co. have been in Toronto for a few days on the company's business.

Mr. M. S. Allen, telephone sales manager, has just returned from an extended trip through the West.

Mr. W. M. Murdoch, formerly of the sales organization of the Montreal house, has been appointed to take charge of the company's sales office at Halifax and has now taken up his duties there.

Railway Board Must Consent

A charge was recently laid against Duncan Miller, superintendent of the Hamilton street railway system by the business agent of the employees, of violating that section of the Ontario Act which regulates the hours street railway motormen and conductors shall work. When the matter came up in the police court it was discovered that the requirement had not been observed which says that no prosecution shall be heard or penalty imposed against a company without the consent of the Railway Board.

Electricity on the Farm

The Hydro-electric Power Commission of Ontario will this fall try out a couple of portable sets for operating threshing machines and other farm implements. The equipment will consist of a transformer and motor mounted on trucks which will be moved from farm to farm. These equipments can only be used in close proximity to the distribution lines. The capacity of the equipment will probably be around 20-25 h.p.

Messrs. Ridout & Maybee, Patent Solicitors, Toronto, are removing from their present premises at Manning Chambers to new and more commodious quarters at 59 Yonge street, corner of Colborne street. Owing to the increase in the legal business of the firm Mr. J. F. Edgar, Barrister-at-Law, has now been associated with the firm as counsel.

Convention of Canadian Municipalities

The 12th annual convention of the Union of Canadian Municipalities is being held at Windsor on Tuesday, Wednesday and Thursday, August 27-8-9. The programme includes a discussion of the Georgian Bay canal scheme by Mayor Hopewell, of Ottawa; a paper on electric franchises by L. A. Cannon, K.C., of Quebec; a description of the Winnipeg hydro-electric plant by Controller Cockburn, of that city, as well as many other topics of interest to municipalities operating their own utilities.

Glover's Vade Mecum

The W. T. Glover Company, Limited, cable manufacturers, of Manchester, Eng., have issued a leather-bound compendium dealing with practically every phase of the manufacture and installation of cables. The subject is treated in eight sections, under the following headings: "manufacture of cables," "cable laying," "jointing, maintenance and testing of cable systems," "colliery installations," "overhead lines," "interior wiring installations," and, useful data and tables and Board of Trade regulations. The whole is contained in a well-bound, well-printed, convenient-size, attractive book of some 420 pages.

New Companies

The Beauharnois Electric Company has been incorporated with a capital of \$200,000. The company asks authority to make and sell electricity in the city of Montreal and Counties of Laval, Jacques Cartier, Hochelaga, Laprairie, Chateaugay, Beauharnois, Soulanges, Vaudreuil, Terrebonne, Assomption, Chambly, Huntingdon, Napierville, St. John and Iberville.

The Arnold Electric Power Station Company has been granted a license by the Provincial Secretary of Ontario. This company has power to acquire, construct, equip, use and dispose of electric plants, patents and electric railways.

The Terminal Electrical Co., Ltd., head office Vancouver, has been incorporated.

Full-sized Illustrations

The Westinghouse Electric & Manufacturing Company are issuing a series of leaflets showing full-sized reproductions of their 7-in. meters. The idea is that by attaching these sheets to the wall representing a proposed switchboard, a correct idea of the readability of the meter may be obtained from various distances and angles. The leaflets cover diagrams of ampere meters, volt meters, frequency meters, wattmeters, power-factor meters and synchroscopes. The idea seems to be a most excellent one and will no doubt assist greatly in the correct planning of many a switchboard lay-out.

The Point Fives

A new society known as 'The Point Fives' has been formed in England which includes within its membership only those who have adopted, within the areas they serve, a charge of 0.5 pence per kw.h. (or less) for electric energy used for domestic purposes. Either municipal, private, or company men are eligible provided their charge for domestic cooking, or cooking and heating, brings them within the required limits.

The increase in the use of electric vehicles in Chicago has been very marked both in passenger cars and commercial trucks. There are in use at the present time about 2,000 passenger vehicles and 250 commercial trucks with some 200 more commercial trucks on order.

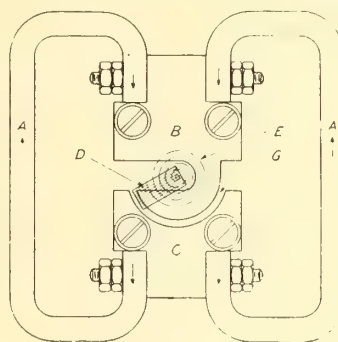
Questions and Answers

D.C. Reading Instruments

Q.—Will you explain how it is an ammeter and voltmeter can sometimes be combined in the same instrument? Is the same degree of accuracy obtained in this case? Kindly answer through the columns of the Electrical News.

A.—The basic difference between a d.c. ammeter and voltmeter is that an ammeter has an exceedingly low resistance, much less than 1 ohm, while the voltmeter has a correspondingly high resistance of many thousand ohms. It is therefore possible to combine the two instruments by

having two sets of resistances, one very small and the other very great, connected to different binding posts. The principle of either of these instruments is the same as that under which the d.c. motor revolves or the same as the principle of a D'Arsonval galvanometer where a coil of wire carrying the current tends to set itself at right angles to



the magnetic flux between two permanent magnet poles. The accompanying illustration indicates the latest type of d.c. meter constructed, as used by one of the largest United States manufacturing companies. This meter operates on the D'Arsonval principle which insures freedom from errors due to residual magnetism and makes a uniform scale distribution possible. It differs from other meters operating on this principle in having only one air-gap in the permanent magnet circuit through which the moving coil swings. The two C shaped magnets A A are provided with soft iron pole pieces marked B and C, each pole piece common to both magnets. The moving coil D is wound on a rectangular aluminium shell and encloses the end of the pole piece B. This coil is so connected that the field produced by the current in it tends to move the coil through the gap with a force proportional to the product of the field of the permanent magnet and the current in the coil. As the field of the permanent magnets in the meter is constant and uniform the torque is proportional to the strength of the current in the coil. This torque is opposed by two spiral springs E one located at each end of the pivot, the restraining force of which is proportional to the deflection. The deflection of the coil is therefore proportional to the current in the moving coil and is read by means of the pointer on a suitable graduated dial. When used as an ammeter the coil D is connected across an ammeter shunt through which the current to be measured passes. The current in the coil is then proportional to the current to be measured. When used as a voltmeter the coil D is connected through a properly adjusted resistance across the voltage to be measured. The current in the coil is then proportional to the voltage. It has not been found practicable to construct the most accurate types of reading instruments on the combined plan though where only fair accuracy is required over a limited range a saving in cost results.

Through the courtesy of the Montreal Light, Heat & Power Company a large number of members of the Montreal Electrical Society on August 3 visited the company's power house at Lachine Rapids. The journey there and back was made in special cars, the use of which was granted by the Montreal street railway company.

Current News and Notes

Ainsworth, B.C.

The Silver Hoard Mine Co. are reported as preparing plans to build a tramway from their mine to the water-front. Engineer, J. B. Hawley.

Berlin, Ont.

On August 31st by-law will be submitted authorizing the expenditure of \$17,000 for purchase of street cars and \$6,000 for extensions to car barns.

Brockville, Ont.

The town council has authorized the signing of a contract with the Hydro-electric Power Commission of Ontario for a supply of power for this town.

Collingwood, Ont.

Work on the erection of poles for the main transmission line which will bring power from the Severn River started about August 1st.

Chicoutimi, Que.

Work at the new dam being built by the Laurentian Construction and Engineering Company is almost completed. The building of the power house will be commenced at once and machinery installed at the earliest possible date.

Canora, Sask.

Tenders were called up to August 5 for crude oil engine and generator with auxiliary equipment to supply the town with light and power. The capacity of the oil engine is 100 B.h.p. and of the generator 50 kw., 3 phase, 60 cycle, 2,300 volts.

Calgary, Alta.

The by-law to raise the sum of \$200,000 for the purpose of construction, equipment and further extending the municipal electric light and power system in the city of Calgary and the by-law to raise the sum of \$40,000 for the purpose of installing and equipping a police patrol system carried by a good majority.

W. J. Harner, Deputy Minister of Railways and Telegraphs, states that the extension to the East Calgary exchange 28 ft. x 60 ft. in dimension will be completed and equipment installed by the first of September. At that time they will be able to meet the increasing demand of Calgary telephone users. During the present year Mr. Harner states that 1,500 new phones have been installed throughout the city.

Duncans, B.C.

The municipality of Duncans contemplates the erection of a plant at Skutz Falls, on the Cowichan River, B.C.

Edson, Alta.

Tenders were received up to Aug. 26 for \$45,000 20-year 5½ per cent. electric light debentures.

Edmonton, Alta.

During Exhibition week this city will operate 45 cars on the street railway system.

Deputy Minister will receive until Aug. 31st proposals for the design, manufacture and fixing complete of electric lighting fixtures for the Parliament Building.

Contract has been awarded to Purcell & Foote for the erection at 21st and

Athabasca streets of a 2-sty., 46 x 70, cement foundation, brick and structural steel telephone building.

Ft. William, Ont.

Council decided not to call for tenders for supply of necessary material for laying of street car tracks on Pacific avenue, Walsh and Franklin and on Island No. 2.

Grand Mere, Que.

Tenders are called for a \$70,000 light and power plant. Surveyor & Frigon, Montreal, are engineers in charge.

Harriston, Ont.

Reported a complete new electric system will be installed.

Hagersville, Ont.

Plans will be prepared and by-law submitted re light and power supply.

Humboldt, Sask.

Plans are being prepared and a by-law will be submitted for a power plant, house and street lighting system. Chipman & Power, Mail Bldg., Toronto, are engineers.

Hamilton, Ont.

The works committee has recommended to the City Council that permission be granted the Hamilton Street Railway Company to extend their lines out King street west to the city limits.

The local hydro-electric board has been notified by the Hydro-electric Commission of Ontario that the price of power to this city has been reduced from original estimate of \$17.92 to \$17 per h.p. per year.

Board of Control awarded contracts as follows: Canada Foundry Co., Toronto, pumps; Canadian General Electric Co., Peterboro, motors and switch-board.

A continuation of Hamilton's White Way, originated by the Cataract Power Company, and stopped by reason of the city's attitude, is now planned by the Hydro department. It is likely that the ornamental standards which now decorate James and King streets will be extended. The company, in making arrangements for the installation, of the standards, figured on a five-year contract from the property owners affected. After many standards had been erected, the city stepped in and refused to allow the work to proceed except on the understanding that they should be removed at the pleasure of the city council. As a result the company refused to erect any more standards. The company now state that they are willing to sell the standards to the city and Engineer Sifton reports favorably on the plan.

Kamloops, B.C.

A complete report of the proposed hydro-electric plant at Barrier River with a steam auxiliary equipment in the city which the engineering firm of Dutcher, Maxwell & Co. have had in preparation for some months estimates the cost of 2,000 h.p. at Barrier at \$237,600. This can be increased to 7,500 h.p. for \$235,000 additional. Cost of the ultimate development of 11,000 h.p. is placed at

\$840,000. The steam auxiliary plant is estimated to cost \$132,000.

Kingston, Ont.

Following the decision of the city council to call for tenders for an extension of its steam plant equipment, the Hydro-electric Power Commission and the Electric Power Co. are both looking into the former offers to see if they cannot make such further inducement as will prevent the city from carrying out its present intention. Latest advices are that the council will adhere to its original intention and instal the steam plant, and that the city council has awarded tenders for two new boilers to Selby and Youlden, Kingston, and for entire turbo generator equipment to the Canadian General Electric Co.

Longue Pointe, Que.

It is reported the Canada Cement Co. will extend plant and increase output by 12,000 barrels per day.

London, Ont.

The residents of Chelsea Green a suburb of London, have circulated petitions asking the city to supply them with hydro-electric power.

It is reported that commencing Jan. 1, 1913, the price of power to the city will be reduced from \$31.00 to \$28.00 per h.p. year.

At the January elections the voters will be asked to pass on the question of electrifying the London and Port Stanley Railway which is municipally owned. Vote will also be taken on the question of buying up the London Street Railway system.

The gross revenue received from private consumers by the London Hydro-electric system for the first six months of the current year is \$47,800 as compared with \$11,400 for the same time in 1911. At this rate of increase it is calculated that the rates can be reduced in the near future.

Medicine Hat, Alta.

A waterworks system at a cost of \$300,000 will be installed. Tenders are called for construction of water works, power station supplies, 3 miles cast iron or steel water mains, 4 centrifugal pumps and electrical accessories.

Moose Jaw, Sask.

Work is being rushed on the Athabasca street extension of the Moose Jaw electric railway system. This work has been delayed by certain city improvements but will now go forward as rapidly as possible.

Tenders opened on Aug. 2nd for steel work for power plant not accepted. City Commissioners instructed to purchase material for immediate delivery. Elec. Supt., J. D. Peters.

On August 1st light and power were provided again from the city's own plant, though the distribution system is not yet complete, many of the wires having been disconnected as they were only able to supply the more congested parts of the city with power obtained from the Robinhood Mills. The city power had been off since May 25th as the power house was partially destroyed by fire.

The new unit is operated by steam and has a capacity of 1,000 kilowatts.

Montreal, Que.

The Montreal Tramways Company has under way an extensive renewal of street intersections. The work is in charge of Mr. J. D. Evans, chief engineer of the company.

According to plans submitted to the Board of Control by the Electric Service Commission, the poles on St. Cathérin street will soon be abolished, and replaced by iron poles of artistic design. The plans show a combination pole for holding the trolley wires and supporting either an arc lamp or an incandescent lamp cluster.

It is reported that a company composed of chiefly French capitalists is being organized with a capital of \$100,000,000 and will ask a franchise to construct an underground electric railway system in this city.

New Westminster, B.C.

City electrician Bowler will be asked to draw up a comprehensive scheme for the placing of lighting and telephone wires in the residential districts underground.

Port Dalhousie, Ont.

This village voted in favor of closing a contract with the Hydro-electric Power Commission of Ontario for a supply of electric power.

Prince Albert, Sask.

Tenders will shortly be called for equipment for power plant at La Colle Falls. C. H. and P. H. Mitchell, engineers.

Quebec, Que.

A deputation from Megantic Council and Board of Trade recently waited on the Minister of Lands and Forests in connection with securing certain water rights on the Chaudière River. The delegates were satisfied that the upper section of the river would be granted to the town except such parts as are already owned by private companies.

Town engineer W. D. Baillairge has awarded contracts for 325 ornamental posts at \$64 each.

Regina, Sask.

Tenders are called up to September 14th for a 1,500 kw. steam turbine unit with switchboard panel, surface condenser for turbine and 25 kw. motor driven exciter.

Salmon Arm, B.C.

On August 12th a vote was taken authorizing the expenditure of \$22,000 for electric light extensions.

Saskatoon, Sask.

By-law was passed by the ratepayers on August 26th confirming an agreement with the Quaker Oats Co., whereby they will be given power to operate their plant at a rate not exceeding 1½¢. per kw.h.

Sudbury, Ont.

Quotations will be received by Inspector, R. Martindale, for a fire alarm system.

St. Catharines, Ont.

Financial arrangements are said to have been completed which will result in the construction of that section of the Dunnville, Welland Port and Beams-

ville electric railway between Dunnville and St. Anns.

Sherbrooke, Que.

The Canada Paper Co. of Windsor Mills are reported to have secured an option on the Overton Falls where it is estimated that 20,000 h.p. can be developed.

The Sherbrooke Construction Co. is reported to have been given a contract for the construction of an electric power house for the Canadian Ingersoll Rand Co.

The Bell Telephone Company contemplate erection of office building for their exchange on present location of old Bellevue Hotel.

Sterling, Alta.

The C. P. R. Telegraph Co. has commenced construction work on their line from Sterling to Cardston.

Stratford, Ont.

Gross receipts from the lighting and power business for the first half of 1912 show an increase of about \$6,500 over the corresponding half year of 1911 with a corresponding increase in expenditures of something less than \$2,000. This represents a probable net increase for the year in the neighborhood of \$10,000 or \$11,000. The system is being extended to Sebringville where it is expected that 150 h.p. will be required.

The Government refuse to sanction the request of the town council to be allowed to enter into an agreement with the Stratford Railway Company, allowing this company to obtain their power from some source other than the Hydro-

Number 5 Knutson Retriever



OVER 800 lines in the United States and Canada use our money saving devices—Catchers, Retrievers, Bases, Headlights.

"Do you want to try them out at our expense."

THE TROLLEY SUPPLY COMPANY
CANTON, OHIO, U.S.A.

electric Commission. The Railway Company threatens to withdraw its offer as they are able to obtain power from other sources at a lower rate than the Commission can supply it. The company has finally made an offer to purchase 100 h.p. at the rate quoted by the Commission. This will probably be accepted.

Thorold, Ont.

The Canadian General Securities Corporation, Ltd., have applied to the municipal council of the Township of Crowland for power to maintain and operate an electric railway, water mains and gas mains along certain roads and streets in the township. By-law is being submitted on the 29th of August.

Toronto, Ont.

The district of Todmorden and Earls-court, suburbs of Toronto, will be supplied by the Hydro-electric Commission with light and power.

The Toronto Electric Light Co. have been granted power by the York township council to place their poles along certain streets.

The retail merchants of this city raised a protest against the tax of \$10 which the city levies annually on each electric sign. It is claimed that this is a special form of taxation not imposed on any other class.

The Dominion Government has agreed to a conference with the cities and municipalities interested, to discuss the question of Dominion Legislation relative to power companies. This is the result of representation made to the Dominion Government following the decision of the Privy Council allowing the Toronto power companies to place poles where it saw fit. The municipalities believe that quite aside from the franchise agreement they should have the right to say where the poles of a private company should be located.

Uxbridge, Ont.

At a largely attended meeting held here recently when the Honorable Adam Beck addressed representatives from the towns and municipalities in the neighborhood, the following rates were quoted by Mr. Beck: Bradford, 200 horse-power at \$54 a horse-power a year; Newmarket, 400 h.p. at \$54.63; Aurora, 250 h.p. at \$39.29; Richmond Hill, 100 h.p. at \$49.98; Markham, 250 h.p. at \$43.70; Stouffville, 150 h.p. at \$41; Uxbridge, 250 h.p. at \$44.75; Port Perry, 200 h.p. at \$54.21; Brechin, 50 h.p. at \$34.64; Canbridge, 15 h.p. at \$55.11; Beaverton, 250

h.p. at \$34.92; Cannington, 175 h.p. at \$44.98; Sunderland, 80 h.p. at \$78.54; Woodville, 70 h.p. at \$61.24.

Victoria, B.C.

Contract has been awarded to Hutchinson Bros. for installing lighting system on Government street and Dallas road.

Vancouver, B.C.

The Western Canada Power Co. is being approached to ascertain whether they would be willing, and on what terms, to take over the city railway system and equipment at the expiration of the present franchise and operate them for a term of years.

Welland, Ont.

The by-law providing for the expenditure of \$45,000 on a municipal distribution plant carried by a large majority. The question of buying out the private plant is not yet decided.

Winnipeg, Man.

The city of Winnipeg has received tenders for 1 transformer for power house at Point du Bois, 300 kw., 3 phase.

Tenders are received by Board of Control until Aug. 29th for 100 ornamental standards, cast iron or steel.

The Great Falls Power Co., through Mr. F. J. G. McArthur, have made application to use the city poles in connection with a proposed automatic telephone system this company wishes to install in opposition to the present government system.

Geo. A. Watson has been appointed Manitoba Government Telephone Commissioner succeeding R. L. Barry, resigned. Mr. Watson is a native of Mooretown, Ont., and for the last two years has been local manager for the Tri-State Telephone Co., of St. Paul.

It is said that the power at Bonnet Falls on the Winnipeg River will be developed in the near future by Sir William MacKenzie interests and that an electric road will be built from Winnipeg along the eastern shore of Lake Winnipeg.

An agreement has been reached between the city and the Winnipeg Electric Railway Co., as a result of which two arbitrators will be appointed to decide terms on which the two companies shall use the same poles for distribution throughout the city.

Alderman A. L. Bond has addressed a letter to the Works and Property Committee which has been referred to the Railway Committee of the city council urging that the new terminal company which has been formed to handle the terminals of the C.N.R., the Great Northern, the Northern Pacific and the G.T.P., be compelled to use electric power within the city of Winnipeg limits.

Woodstock, Ont.

New electric lights in east end of town, new standard globes, wiring, etc., will be purchased.

Walkerville, Ont.

The Dominion Stamping Co. have awarded contract for engine room for power plant to Wells & Gray, Confederation Life Bldg., Toronto, engineers and contractors.

Moonlight Schedule for September, 1912

Courtesy of the National Carbon Company, Cleveland, Ohio.

Date.	Light.	Date.	Extinguish.	No. of Hours
Sept 1	7 00	Sept 1	10 10	3 10
2	7 00	2	10 40	3 40
3	7 00	3	11 20	4 20
4	7 00	5	0 10	5 10
5	7 00	6	1 00	6 00
6	6 50	7	2 10	7 20
7	6 50	8	3 30	8 40
8	6 50	9	4 50	10 00
9	6 50	10	4 50	10 00
10	6 50	11	4 50	10 00
11	6 50	12	4 50	10 00
12	6 40	13	4 50	10 10
13	6 40	14	4 50	10 10
14	6 40	15	5 00	10 20
15	6 40	16	5 00	10 20
16	6 40	17	5 00	10 20
17	6 40	18	5 00	10 20
18	6 30	19	5 00	10 30
19	10 10	20	5 00	6 50
20	11 10	21	5 00	5 50
22	0 10	22	5 00	4 50
23	1 20	23	5 00	3 40
24	2 20	24	5 00	2 40
25	No Light	25	No Light	
26	No Light	26	No Light	
27	No Light	27	No Light	
28	6 20	28	8 20	2 00
29	6 20	29	8 40	2 20
30	6 10	30	9 20	3 10

Total.....181 50

"UNION" UNIVERSAL BOX No. 180

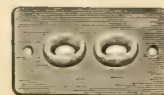
Suitable for Switch or Open Conduit work—having a complete line of Covers for all styles of Attachments, Drop Cord, Fixture, Receptacles, etc.

May we send you a sample?—Write to-day

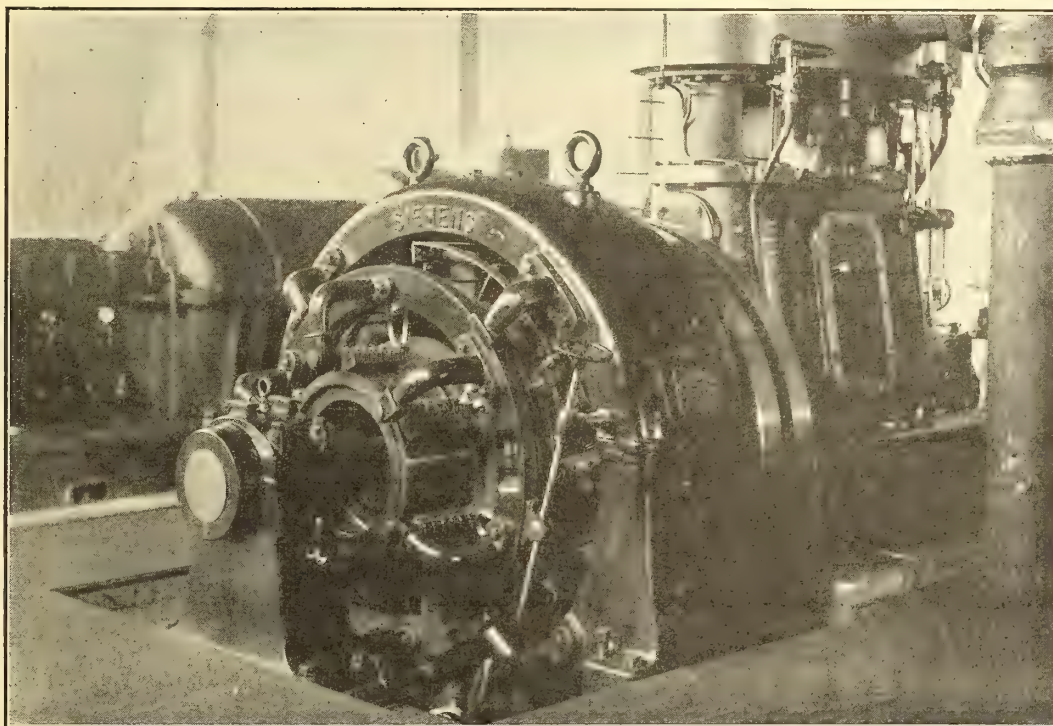
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Represented by

Central Electric & School Supply Co., TORONTO, ONT.



SIEMENS



Siemens 400 K. W. 550/600 Volt Direct Current Traction Generator Supplied and Installed for City of Regina.

We have also received a repeat order for a second Generator as shown after the existing set had been running nearly twelve months.

We have supplied or on order a large number of **Direct Current Generators** in Canada amongst which we could mention the following:—

One 800 K. W.—Canadian Collieries.	Two 400 K. W.—City of Regina.
One 700 K. W.—Canadian Collieries.	One 400 K. W.—City of Lethbridge.
One 800 K. W.—Dominion Coal Co.	One 220 K. W.—Dominion Coal Co.
One 750 K. W.—City of Edmonton.	One 200 K. W.—City of Lethbridge.
Two 500 K. W.—City of Port Arthur.	One 150 K. W.—Canada Sugar Refining Co.
Two 500 K. W.—Nova Scotia Steel & Coal Co.	One 150 K. W.—Winnipeg General Hospital.
	Two 500 K. W.—City of Winnipeg.

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Berlin

St. Petersburg

Vienna

New York

Head Office for Canada

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Branch Office: 707 McArthur Building, WINNIPEG

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	RATE
Positions Wanted	2 cents a word per inser-
Positions Vacant	tion.
Miscellaneous.	

Tender advertisements, equipment for sale, etc., 15 cents per agate line (14 agate lines make one inch) per insertion.

Advertisers who wish to conceal their identity may do so by using an Electrical News box number without extra charge.

Forms close on the 18th of each month.

Situations Wanted

Position wanted as Manager or Superintendent of small plant. Ten years experience. Excellent references. Box 523 Electrical News.

Position wanted in charge of small plant. Excellent references. Fifteen years' experience. Reply to E. Scott Rivett, 17 Brunswick Street, Montreal, Que.

Specialist in Meter, Instrument and Switchboard Apparatus, Design and Manufacture, good organizer, requires leading position. Prepared to take charge of Department or Works. Excellent credentials. At present in England. Reply, A. M. I. E. E., Box 544, Electrical News, Toronto, Ont.

Position wanted as Assistant Manager, Sales Engineer or Chief Draughtsman by engineer with varied experience in boiler and steel plate work, steam and water power plants and general machinery. Successful record; best references. Address Box 557, Electrical News, Toronto, Ont. 9

For Sale

Ayr electric light plant in first class condition, steam power, good service and contracts. Exclusive franchise in town of 1,200. A splendid chance for a practical man. Being sold because of owner's death. Apply D. M. Clark, 15 McKenzie Crescent, Toronto, Ont. 2-TF

Patents For Sale

The proprietors of Letters Patent No. 127080 relating to "Process of Manufacturing Iron Electrodes for Use in Alkaline Accumulators," and No. 127081 relating to "Active Masses for Positive Electrodes of Electric Elements, etc.," desire to dispose of the Patents or to grant Licenses to interested parties at reasonable terms with a view to the adequate working of the Patents in Canada.

Inquiries to be addressed to the actual proprietors, Svenska Ackumulator Aktiebolaget Lungner, Stockholm, Sweden.

Machinery For Sale at Friday Prices

- 1—5 kw., 110 Volt Compound C. G. E. Type B Generator.
- 1—7½ kw., 110 Volt Compound Westinghouse Type S. Generator.
- 1—110 kw., 550 Volt D.C. C. G. E. Compound Belt Driven Generator.
- 15—500 Volt D.C. Motors, 1 to 15 h.p.
- 4—½ H.P. Century and Wagner S. P. 125 Cycle Motors.
- 1—200 kw. 125 Cycle, 2 Phase, S. K. C. Generator, 2,300 Volt, just like new, with or without Tandem Wheelock Engine and Condenser.

The above apparatus is guaranteed just as good as new. Price about one-half their original value.

Apply,
MACKENZIE ELECTRIC CO.,
Sarnia, Ont.

9-10

CITY OF REGINA

Tenders for Electrical Plant

Sealed tenders addressed to the City Commissioners and marked "Tenders for Electrical Plant," will be received until noon on Saturday, the 14th day of September, for the following:—

- 1—1500 KW. Steam Turbine Unit.
- 1—Switchboard Panel.
- 1—Surface Condenser for Turbine.
- 1—25 KW. Motor Driven Exciter.

Specifications may be obtained on application to the office of the City Electrician.

A certified cheque for 5 per cent. of the amount of the tender must accompany each tender.

The Commissioners reserve the right to reject any or all tenders.

(Signed) A. W. POOL,

City Clerk.

Dated at Regina, July 16th, 1912

9

With the great protection of duty afforded Canadian manufacturers of electrical goods, coupled with the fact that there are practically no switchboards or panel boards made in Canada, most of this material now being imported, we are in position to offer a wide-awake man the chance of a life time. We are electrical contractors in the States, and have also carried on the manufacturing of panel boards, metering boards and cabinets, but owing to the conflicting nature of the two, we have decided to abandon the manufacturing business. We, therefore, offer for sale our entire plant, consisting of machinery, dies, tools, copper, slate, raw, semi-finished and finished material, templates, cost records, drawings, cuts for catalogues, etc. We will dispose of this as a whole at a sacrifice and on a cash basis.

Apply Box 505, Electrical News, Toronto, Ont. 68 F

Porzellanfabrik Hermsdorf

Sachsen-Altenburg, Germany



Wall Duct for the High Tension Transmission Station of the

Hydro-Electric Power Commission of Ontario

110,000 Volts

Sole Agents for Canada

Watson Jack & Company

709 Power Building, MONTREAL

New WESTON INSTRUMENTS

A Full Line of Alternating Current Switchboard Indicating Instruments

is offered by this Company, comprising:

**WATTMETERS, Single and Polyphase.
POWER FACTOR METERS.
SYNCHROSCOPES.**

**FREQUENCY METERS.
VOLTMETERS.
AMMETERS.**

and New Models of Weston D.C. Instruments to match

This whole group of instruments embodies the results of several years exhaustive study and scientific investigation of all the complex electrical and mechanical problems involved in the development of durable, reliable, sensitive and accurate instruments for use on alternating current circuits.

Every detail of each of these instruments has been most carefully studied and worked out so as to be sure that each shall fully meet the most exacting requirements of the service for which it is intended. Neither pains nor expense has been spared in the effort to produce instruments having the longest possible life, the best possible scale characteristics, combined with great accuracy under the most violent load fluctuations and also under the many other trying conditions met with in practical work. Every part of each instrument is made strictly to gauge and the design and workmanship and finish is of the highest order of excellence.

We invite the most critical examination of every detail of each member of the group. We also solicit the fullest investigation of the many other novel features and very valuable operative characteristics of these new instruments and request a careful comparison in all these respects with any other make of instrument intended for like service. We offer them as a valuable and permanent contribution to the art of electrical measurement. Their performance in service, will be found to justify the claim that no other makes of instruments approach them in fitness for the service required from A.C. Switchboard indicating instruments.

Full particulars of design, construction, prices etc., are given in Catalogue E. N. 16. Write for it.

WESTON ELECTRICAL INSTRUMENT CO.

Main Office and Works, Newark, N. J.

New York, 114 Liberty St.
Chicago, 1504 Monadnock Block.
Boston, 176 Federal St.
Philadelphia, 342 Mint Arcade.
Birmingham, Brown Marx Bldg.
Detroit, 44 Buhl Block.

St. Louis, 915 Olive St.
Denver, 231—15th St.
San Francisco, 682 Mission St.
New Haven, 29 College St.
Cleveland, 1524 Prospect Ave.

Paris, 12 Rue St. Georges.
Berlin, Genest St. 5 Schoenberg.
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Vancouver } Manufacturing
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POWER CABLES

For Working Pressures up to

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Cablegrams "Insulator" Montreal
Telephone Main 1521, Montreal

Power Building, Montreal



No. 13502 Tungstolier

Hammered Fixtures another Tungstolier Product

¶ These fixtures which are made in over 100 designs, are cast of BRASS, and hand hammered to perfectly produce the ancient method of beaten metal.

¶ Beautiful and artistic effects can be obtained with these designs for Dining Rooms, Grills, Cafes, Clubs, etc.

THERE IS A TUNGSTOLIER FOR EVERY PURPOSE

The Tungstolier



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NEWTYPE BERGMANN LAMPS

(Tungsten Filament)

The Unbreakable Kind

Are Now Ready for Delivery

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EXCLUSIVE CANADIAN DISTRIBUTORS

P. H. KLEIN, Jr., CO.

329 CRAIG STREET WEST
MONTREAL, P. Q.

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P R O D U C T S

WE control the Canadian rights for the celebrated lamp for which the Brush Electrical Engineering Company is famous.

METALLUM

The lamp with a reputation won in service.

May we send you a little booklet called
"LIGHT BILLS GOOD-BYE"

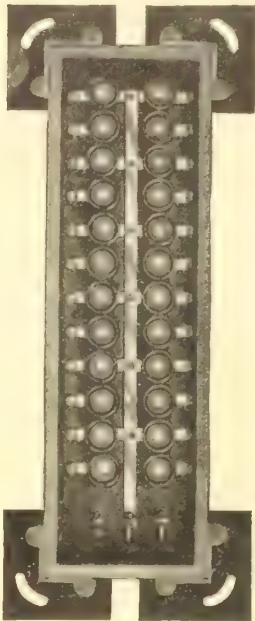
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Your sales of

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will receive an added impetus if you offer **this New Iron**. It is certainly the most perfect model that has ever been produced. All the old drawbacks of earlier models have been overcome. It consumes 20% less energy at a given heat than any other Iron on the market. It will **never** burn out. Rated voltage 110 v. tested for 20 minutes at 220 v. The most serviceable and economical electrical appliance ever made.

The new electric 3 heat disc stove is most carefully constructed to give the greatest heat at the smallest working cost. It is strongly made and beautifully finished, it will never break or burn out.

Royce Electrical Economic Heating Appliances are luxuries within the reach of **all**—the busy hostess, college girl, maid or bachelor. The time, money and trouble they save, the dirt and danger they do away with will make them the most popular Heating Appliances for your season's trade.

Royce & Co., Manufacturers, West Toronto, Ont.

Write to-day for illustrated catalog and Agency terms.

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Best answers
the purpose
for a device
of its kind
and the
price is
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Used
by leading
Lighting, Trac-
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Companies in the
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who have recognized its superior
construction and adaptability.
This coupling makes a joint that is a
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Write for descriptive folder and prices.

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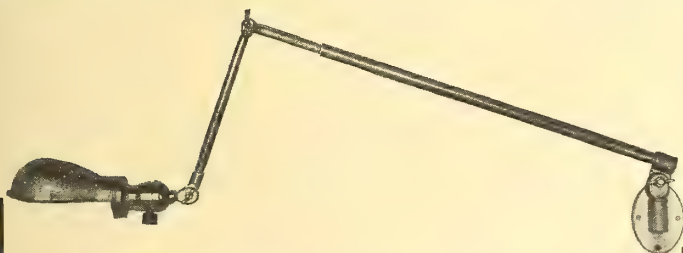


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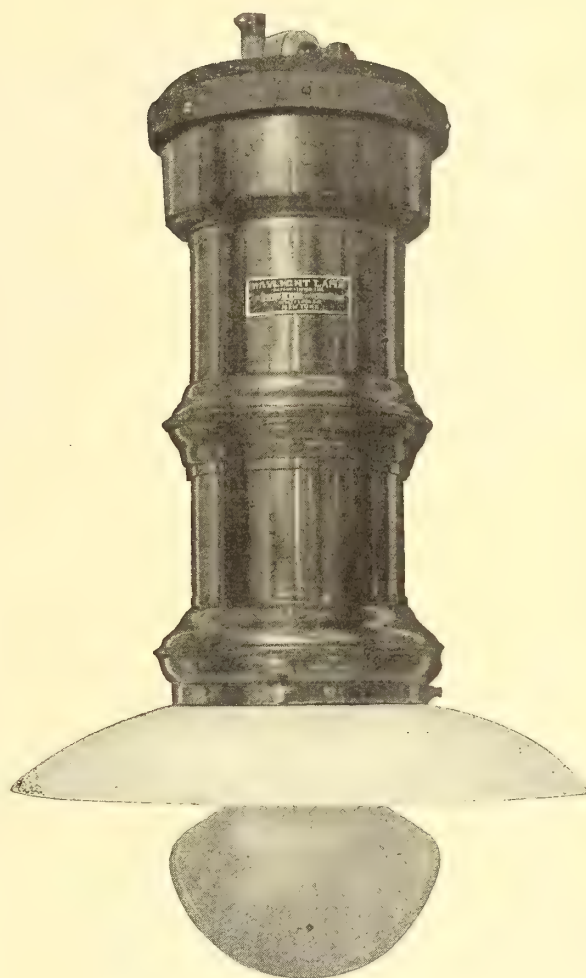
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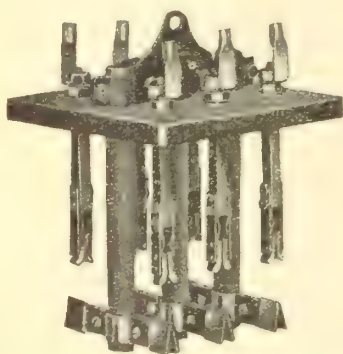
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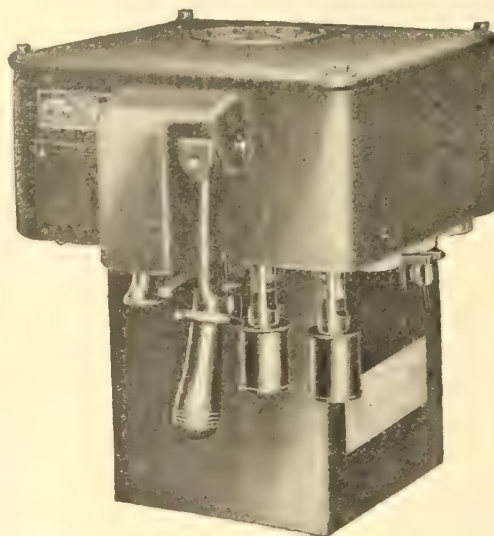
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---What it means to the Plant

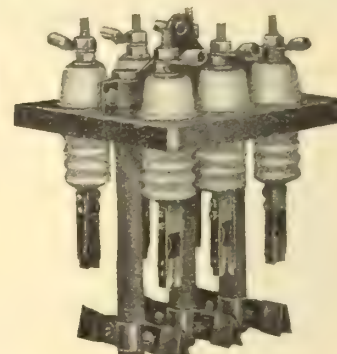
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Contacts, insulation and terminals
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Type F. Form K-20 Oil Switch complete with
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Contacts, insulation and terminals
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The C. G. E. "K-20" Oil Switch was designed specifically to meet the exacting conditions which are experienced in textile and flour mills, woodworking plants, powder works, coal mines, gas works, oil refineries or in any industry where there are inflammable materials or explosive gases.

It is *simple*, *compact* and *durable*.

It is entirely enclosed and perfect in every single detail.

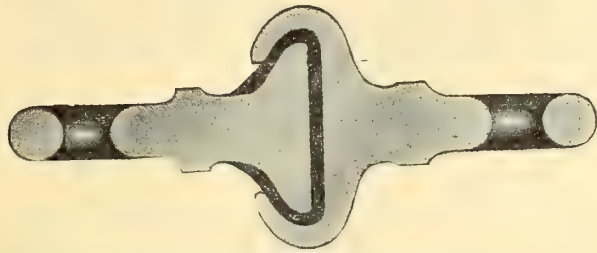
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Complete information and prices are given in Bulletin 4911, a copy of which will be gladly supplied upon request.

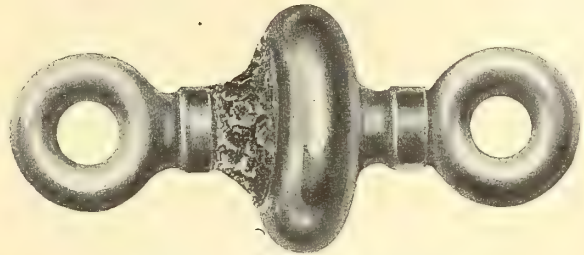
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Head Office: TORONTO

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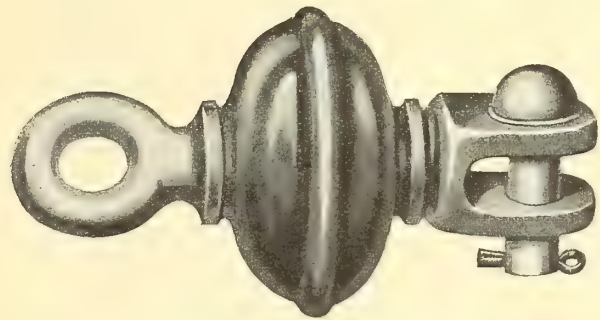


Section showing insulated joint



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Complete-Strain Insulator

A perfect mechanical and electrical strain insulator.

Only sheet **mica under compression** is subjected to mechanical and electrical stresses.

The insulated joint is protected from the weather by **non absorbent** insulating compound.

The mechanical strength of the C. G. E. Giant Strain Insulator is limited only by the strength of the metal eyes or clevises.

All metal parts are **sherardized**.

Every insulator is tested before shipment.

2" diameter	-	-	2500 lbs.
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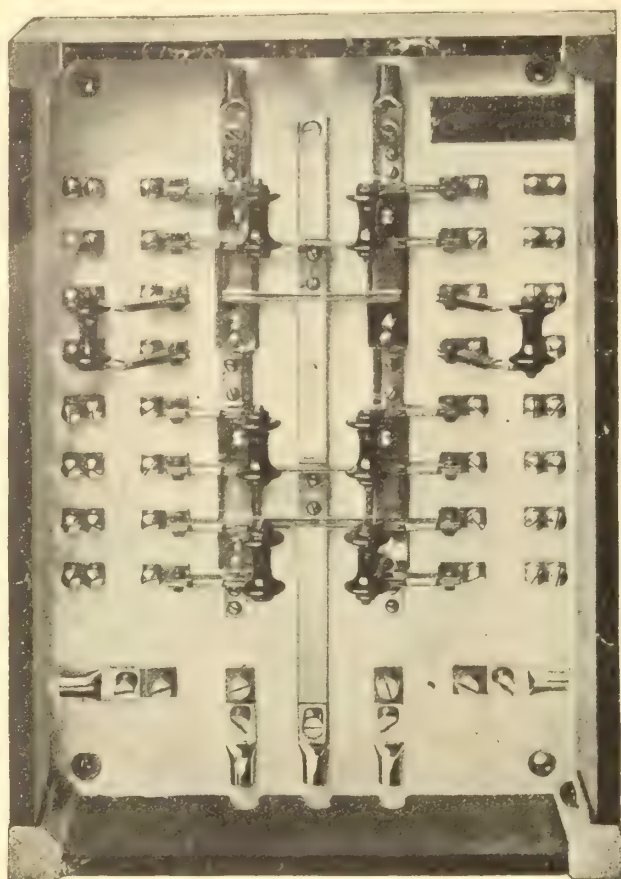
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Large stocks are now at our local offices ready for immediate shipment.

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Switch Boards

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Are the make used in many of the largest institutions, office and government buildings in the United States and Canada.

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That means us. Our British Columbia stocks are complete, and they're the finest poles grown anywhere—straight, sound, and strong. We can ship them quick, and that means a lot at this season of the year. Wire us for prices today.

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**Large Stock
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Send us your next order and be assured of the best possible service. Let us demonstrate the manner in which we take care of our customers.

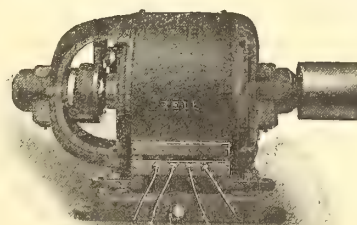
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Meet All Requirements



Large stock carried throughout the country for immediate shipment.

Attractive Prices consistent with QUALITY

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IN B. C., IDAHO AND WASHINGTON. WE SHIP FROM OUR

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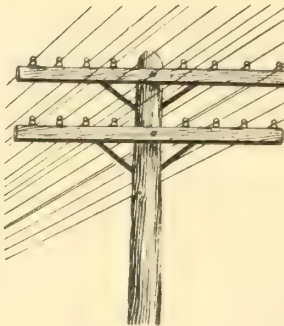
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Our specialty is manufacturing Cross-Arms from sound straight-grained Douglas Fir.

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CAMPBELL TIME SWITCH THE BEST (PATENT)

Clock movement improved, powerful, built in our own factory.

Fly wheel operates switch. Released by Trip Hands on clock dial coming in contact with Trip Lever.

Porcelain barrier, allows small compact knife switch

Porcelain Bushings, extension of the switch porcelain. Leads entering at bottom - exclude moisture

Regulate Clock

Pointer indicates time on clock dial.

Clock Dial revolves carrying Trip Hands with it. Set by loosening thumb nut.

Geared lock. Draws door tight all around to a rubber gasket.

Weather proof iron box.

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are designed and made to give the maximum efficiency under the most severe conditions. Uniform glaze, body and appearance. Made for voltages from 4,000 upward.

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We have large stocks of them for prompt shipment at low freight rates.

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Electric Lighting Supplies

LAMPS, SOCKETS, ROSETTES, WIRES, CORDS,
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Large Stocks - Prompt Shipments

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Our yards are located adjacent to Canadian Territory which guarantees

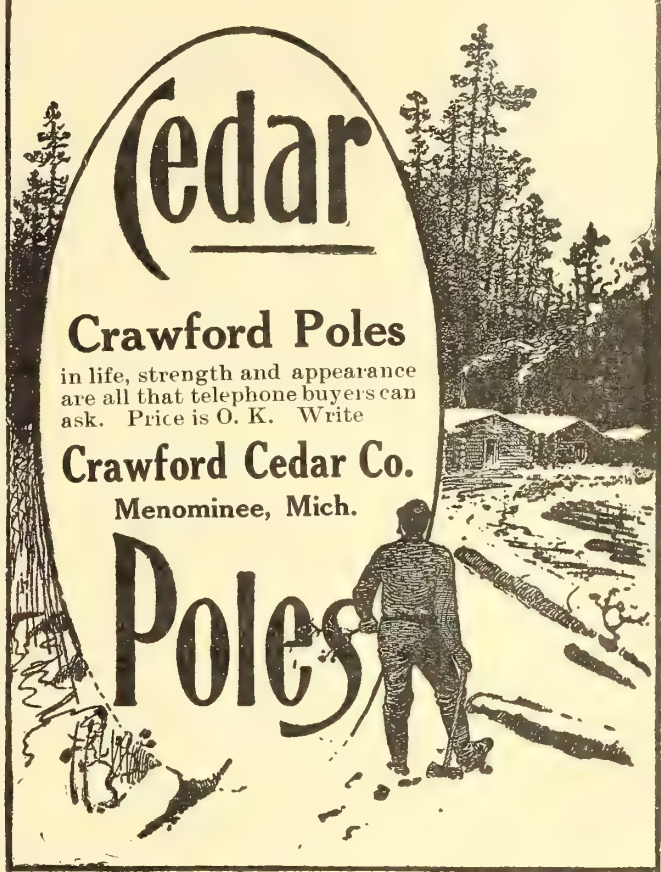
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Service Price Quality
Try Us Once

POLES

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Crawford Poles
in life, strength and appearance are all that telephone buyers can ask. Price is O. K. Write
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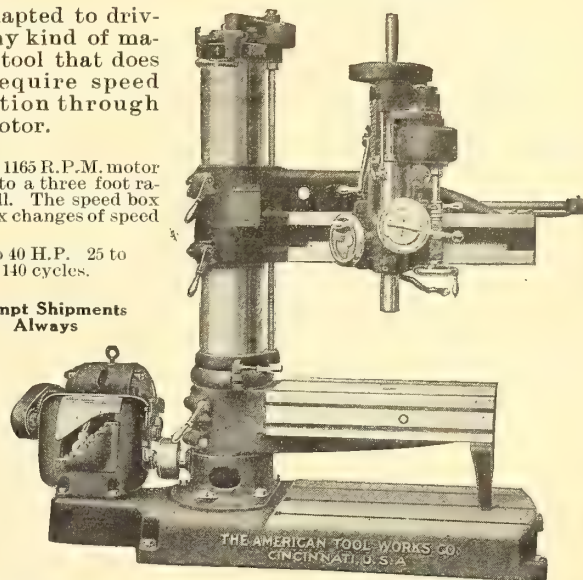
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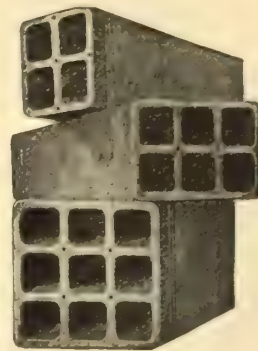
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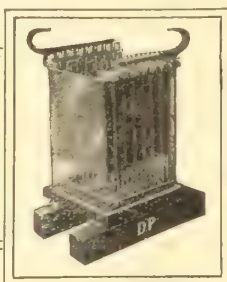
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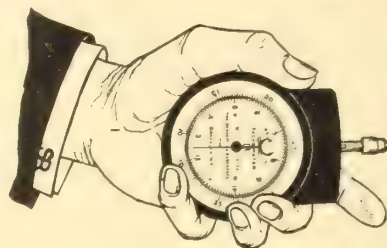
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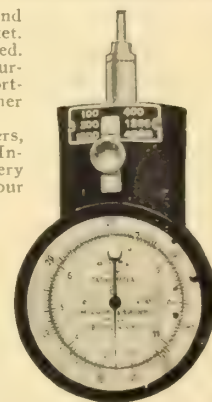
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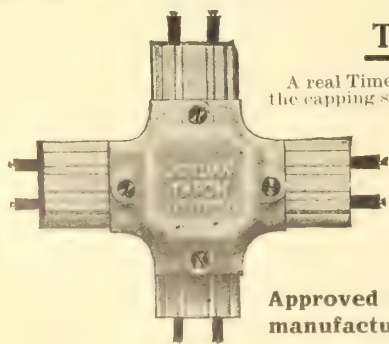
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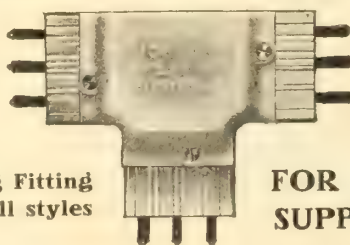
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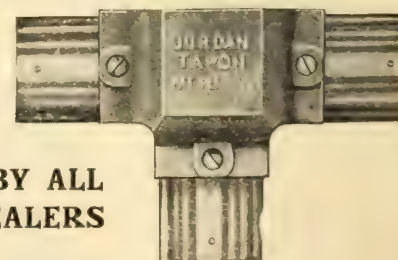
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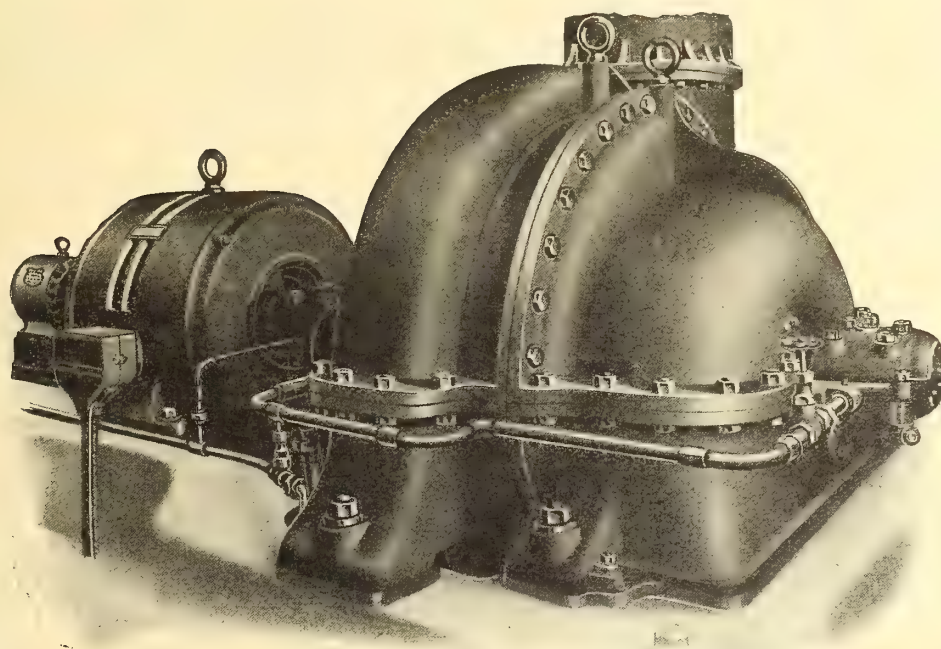
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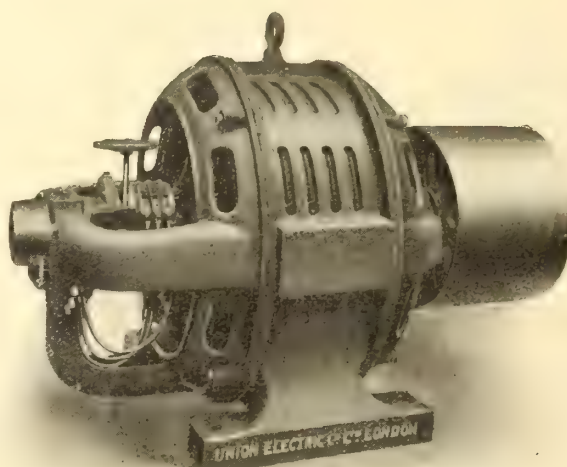
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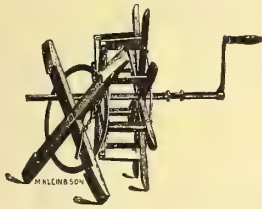
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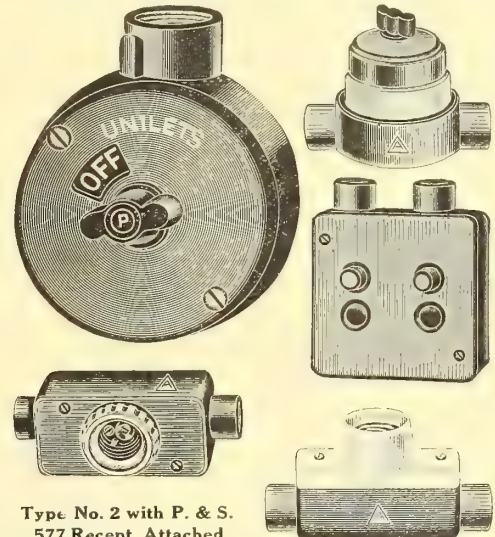


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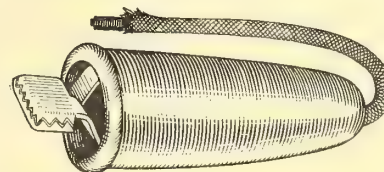
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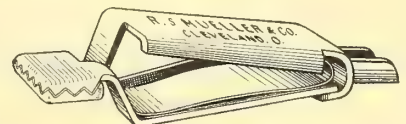


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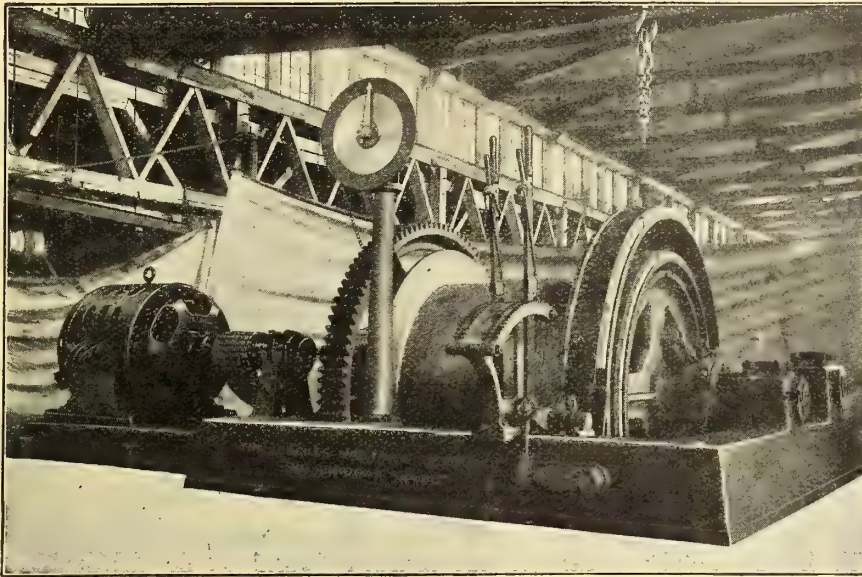
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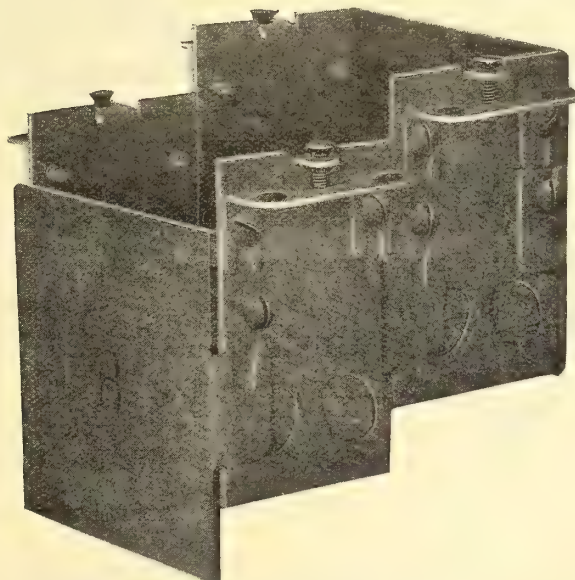
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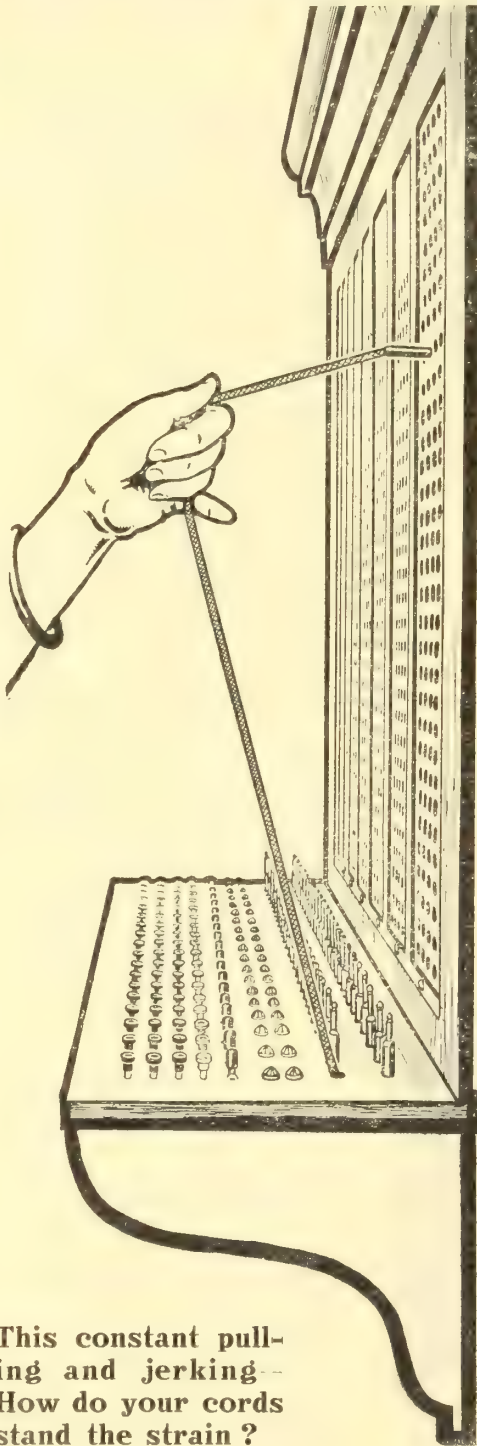
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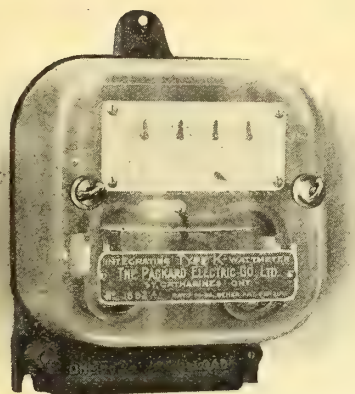
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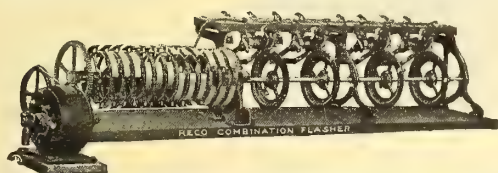
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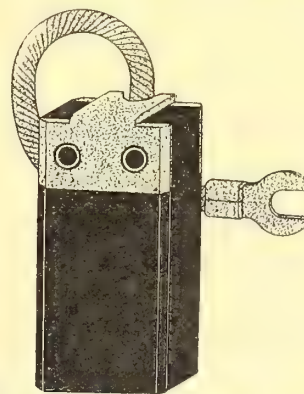
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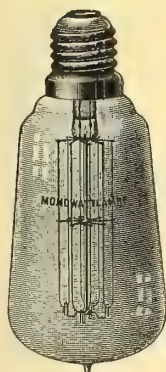
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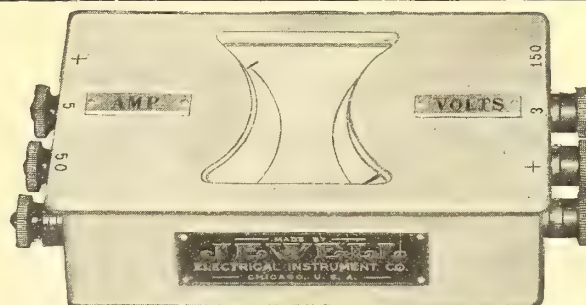
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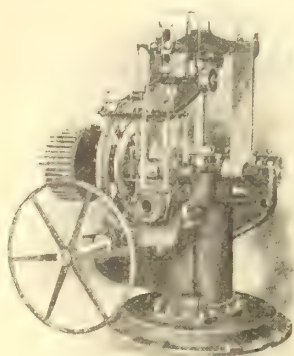


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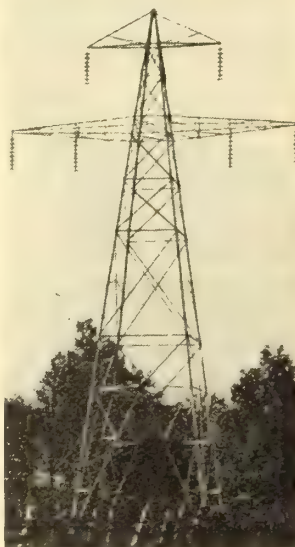
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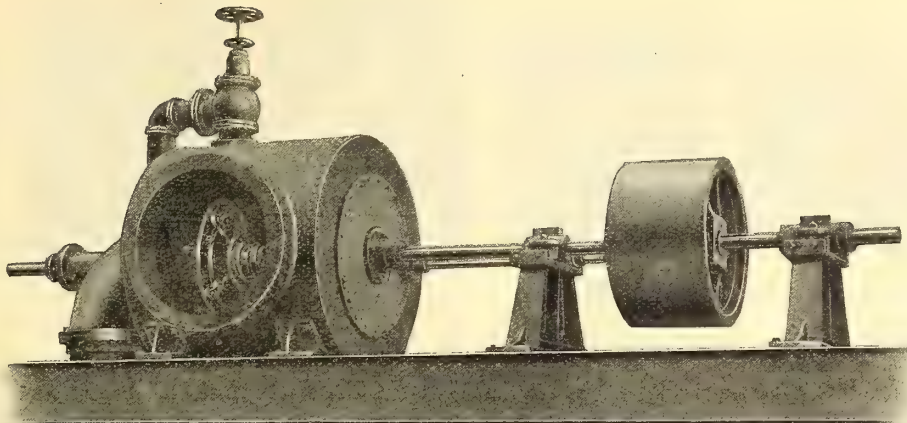
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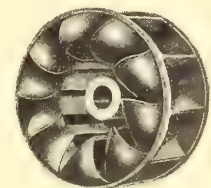
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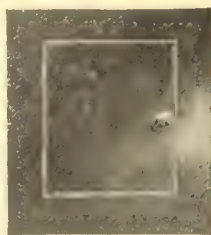


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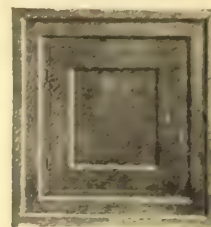
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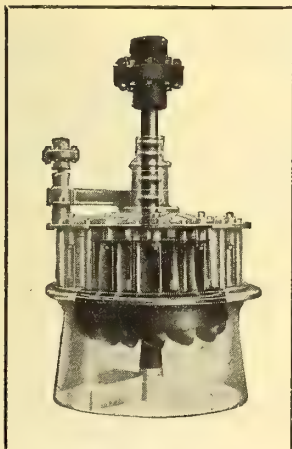
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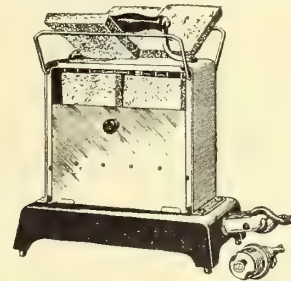
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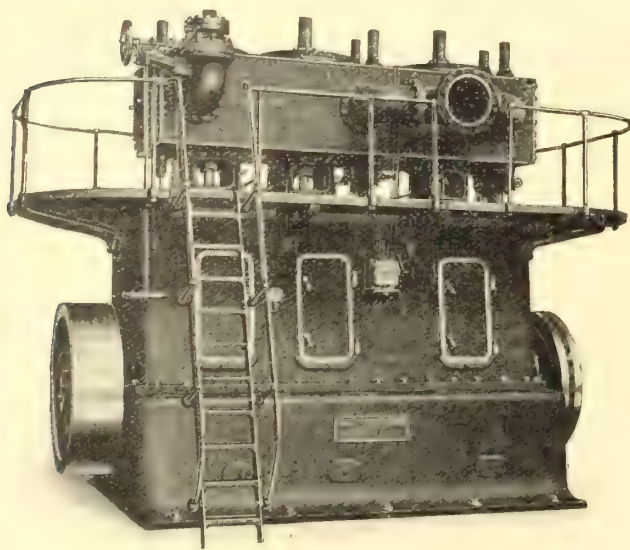


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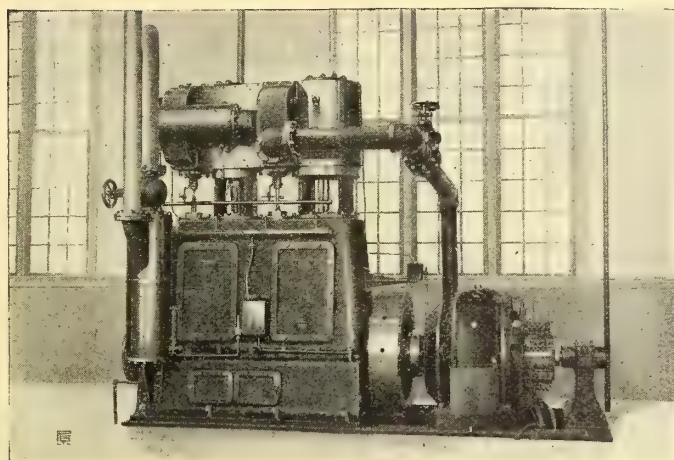
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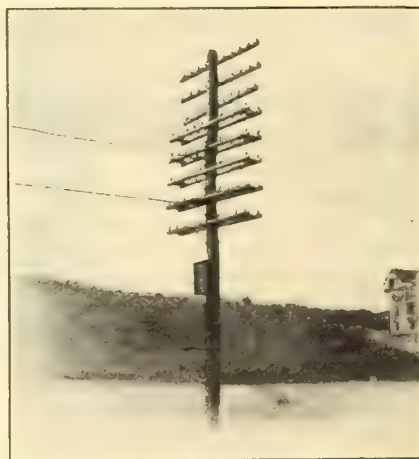
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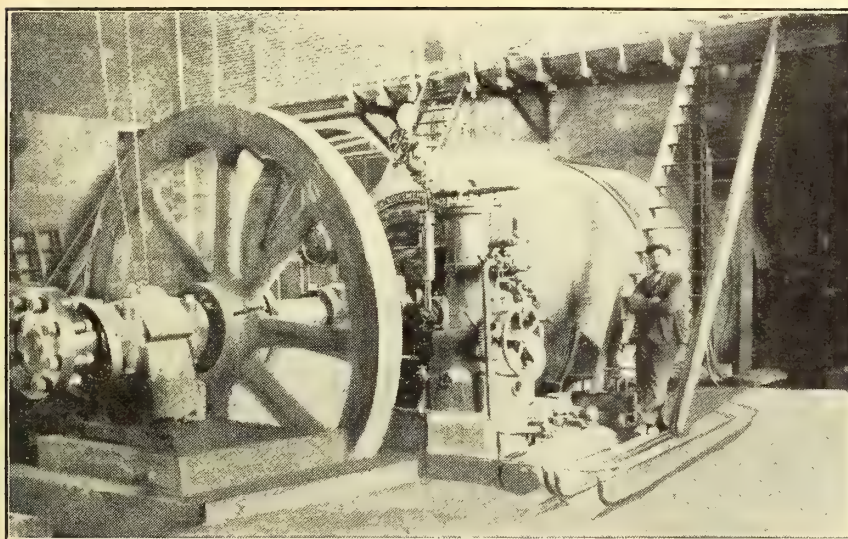
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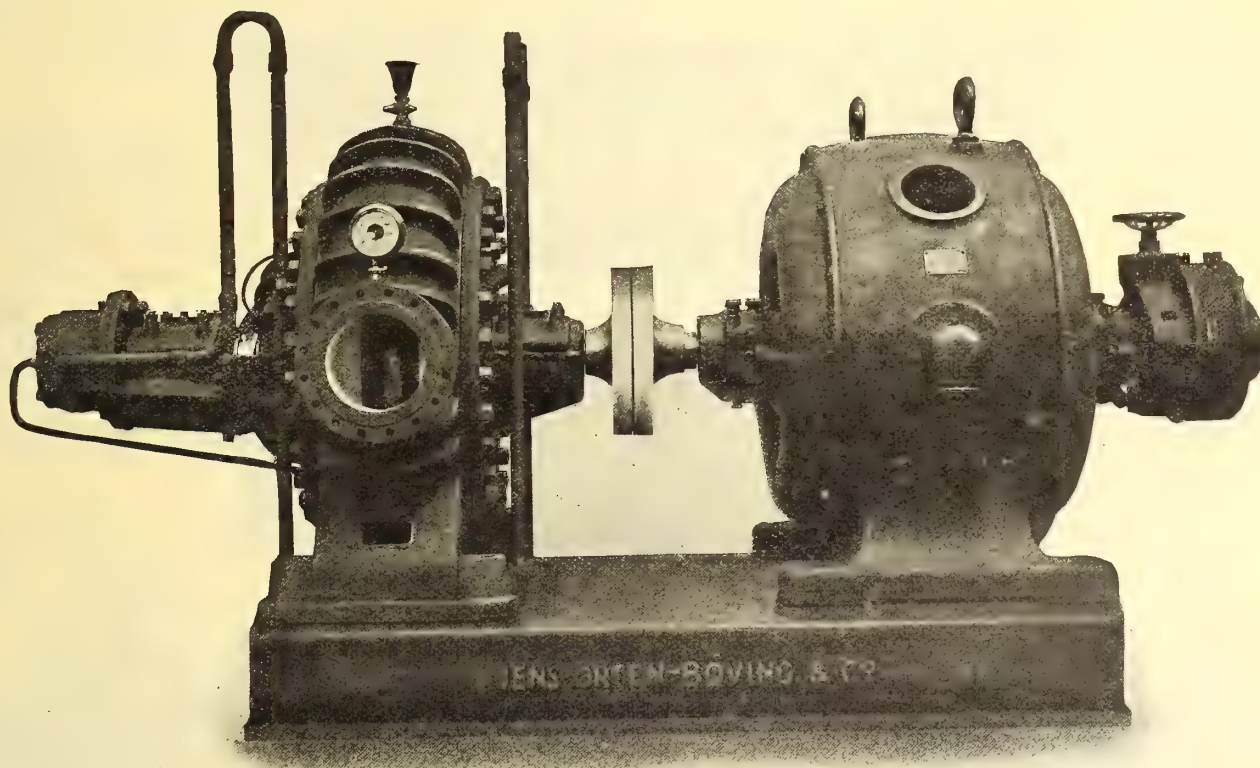
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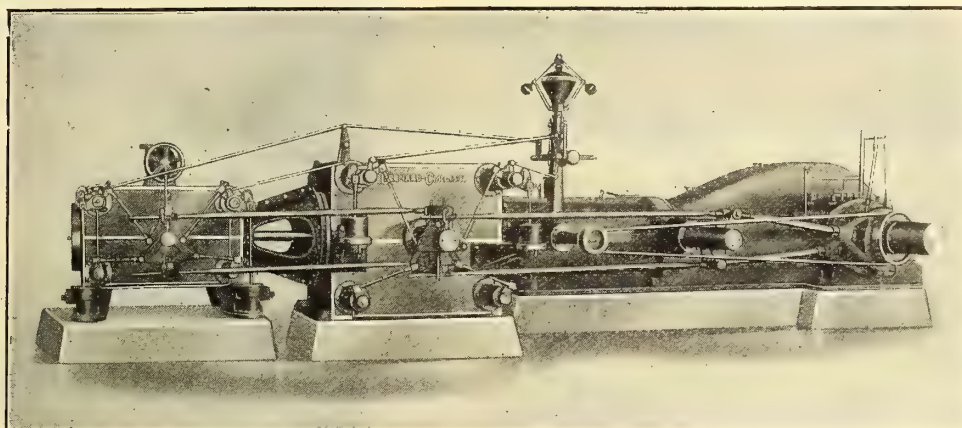
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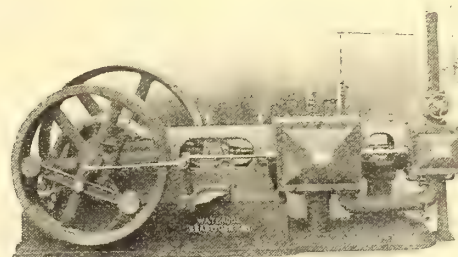
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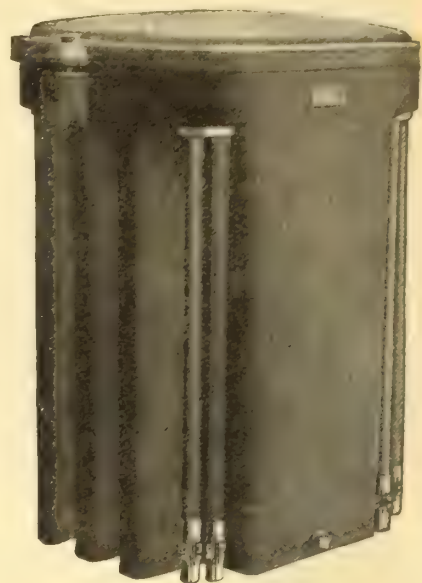
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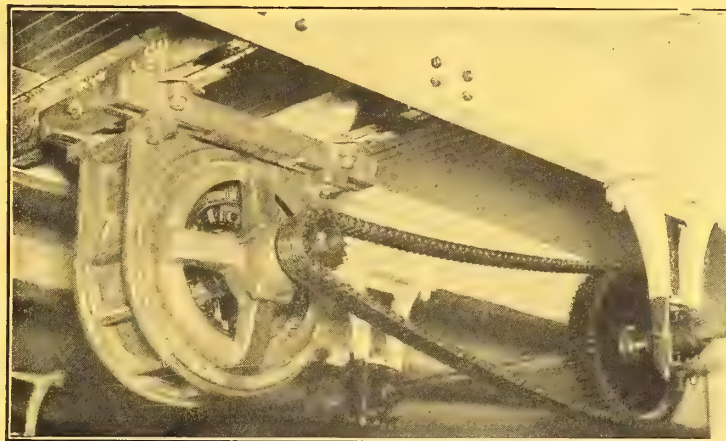
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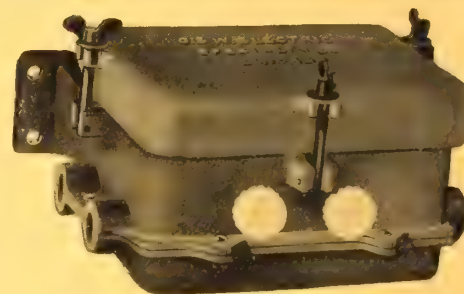
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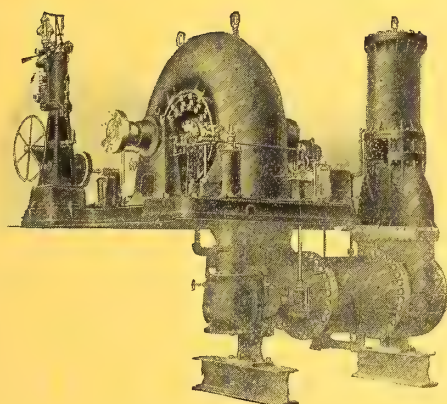
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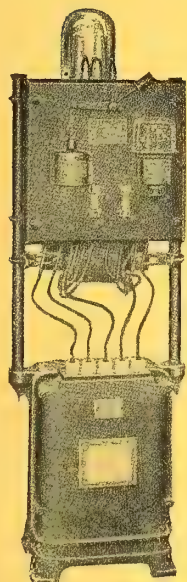
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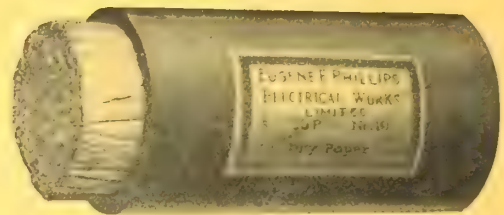
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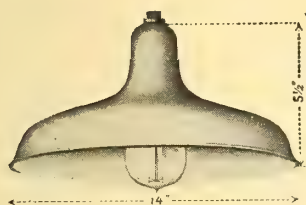
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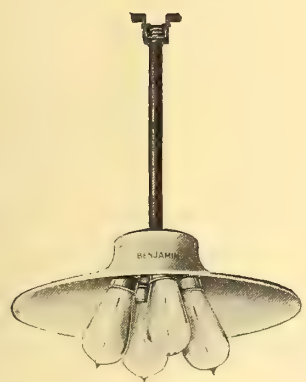
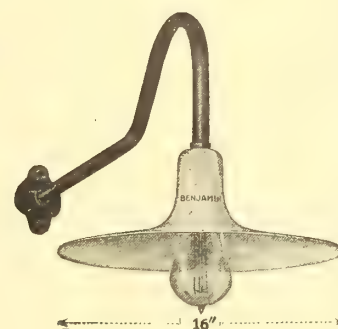
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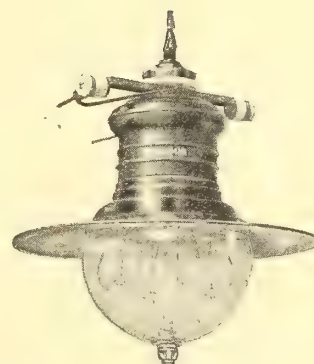


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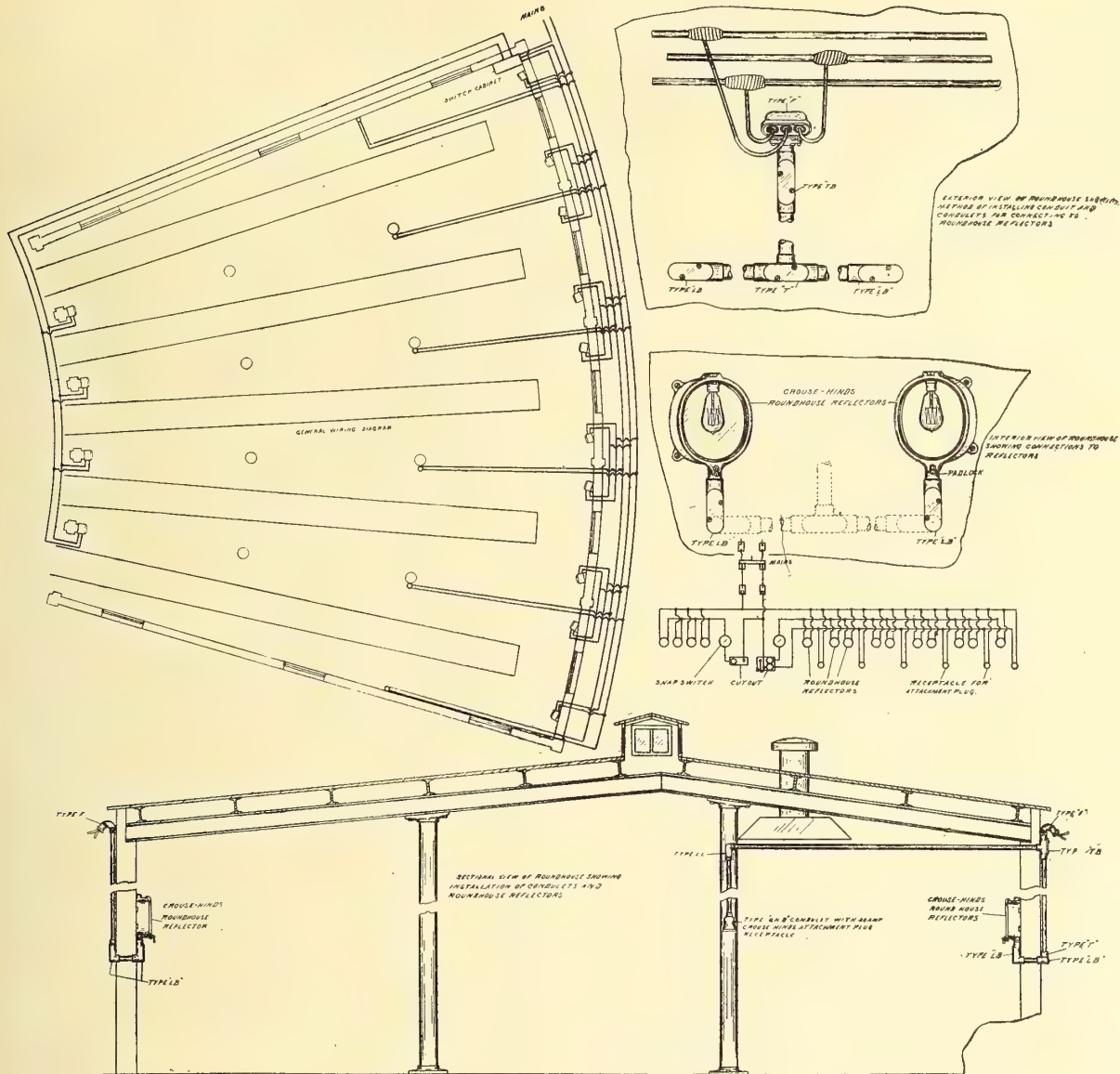
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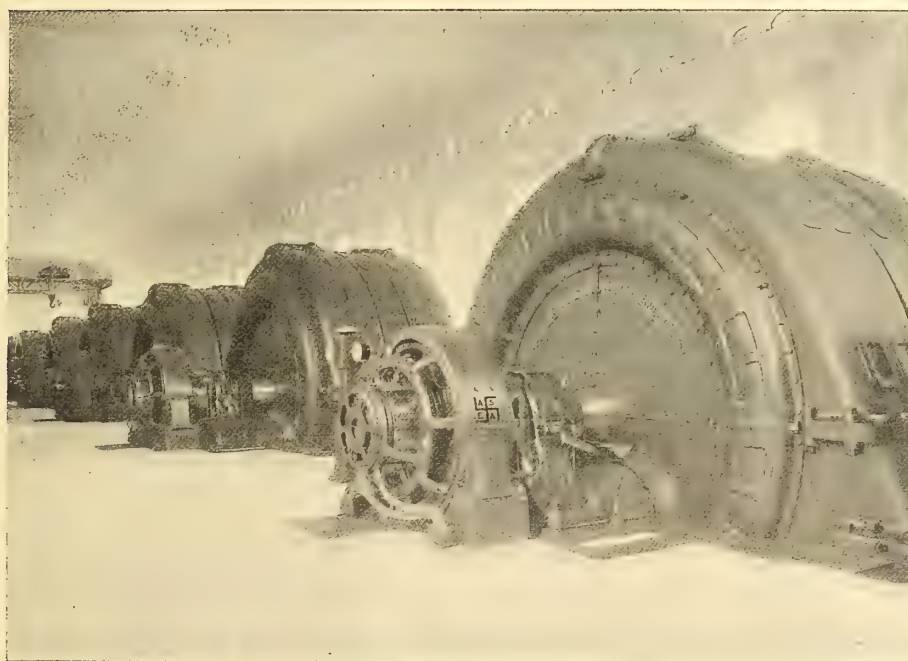
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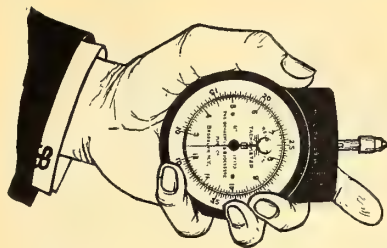
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Electric Vehicle Assn. of America . .	29				
Electric Railway Improvement Co. .	22			Zimmerman Co., W. H.	96

The Advertisements in the "Electrical News" represent the leaders in their line



Have you Speed Troubles?

Then it's a sure sign you need a Tachometer. It's the only positive remedy for speed troubles of every character. If it is a certain shafting, turbine, motor, machine or the like that bothers you, install a stationary tachometer and your troubles are ended. Should you require a portable Tachometer for testing numerous different shaftings then you want a hand tachometer. And the best in hand tachometers is represented by our line of

S. & B. Columbia Tachometers

They are the neatest, most compact and durable Hand Tachometers on the market. And as for accuracy they are unequalled. There are numerous styles for every purpose at varied prices. They possess important individual features not found in other types.

And we don't stop at hand tachometers, for we have a complete line of Stationary Indicating and Recording Tachometers for every conceivable purpose. All described in our Tachometer bulletin.

Write for Bulletin H23—Now.

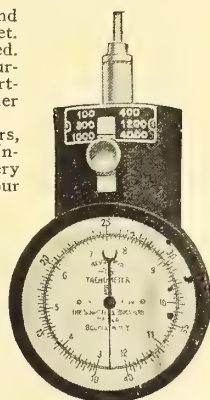
See our exhibit at the Industrial Exhibition.

**The
Schaeffer & Budenberg
Mfg. Co.**
BROOKLYN, N. Y.

Chicago

Pittsburg

(87)



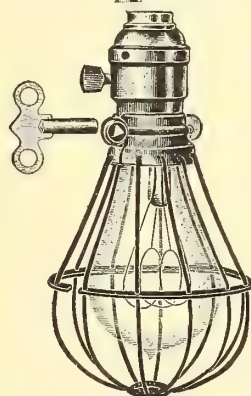
A Type of Hand Tachometer

LOXON and Fall Business

No line offers a bigger field for both user and dealer than the Loxon Lamp Guard.

It is the one safeguard that will serve and satisfy fully—and at this time of the year it offers “big game” to the hustling dealer who will take it up and give it a little attention.

**LOXON
LAMP GUARD**
THE KEY TO SAFETY



Widely advertised, already very popular, it never comes back except with repeat orders.

Loxon offers such money-saving possibilities to the user that it sells easily when displayed and explained.

Are you ready to pick the fruits that are now ripe?

Get in touch with us now, for the picking is worth while.

Write us for prices and discounts.

**Loxon is carried by leading
Canadian Electrical Houses**

McGill Mfg. Co.
5 Oak St., Valparaiso, Ind.

Talk No. 3

A customer stepped into “THE MAINER ELECTRIC COMPANY’S” premises, at 61 Albert street, and after a casual survey of the shelves, on which reposed quantities of the new stock of electrical supplies just received from our several factories, he said:—

“What lines of goods do you carry?”

“Everything Electrical,” an obliging clerk answered.

“But—said the customer—what special lines of goods can I depend on buying, right from Winnipeg stock?”

Our customer set us thinking and we made a quick inventory of the shelves something as follows:—

American Electrical Heater materials; Chicago Fuse Mfg. Co., fuses, cutouts and boxes; Duncan sockets, rosettes, receptacles; Pass & Seymour specialties; Hughes electric ranges and hot-plates; Hubbell sockets and plugs; Connecticut switches, and kindred appliances; Columbia dry cell batteries; Benjamin lighting specialties; Appleton unilets; Matthews lamp guards; Boston insulated wires and cables.

We did not wish to burden our customer with too many items, so we let him have just a few of the important ones, and he seemed quite satisfied with the information.

We expect to do a large business for a brand new jobbing house, this Fall, and we want the trade to investigate us. We have nothing but the latest products of the most standard electrical factories, and we buy in Canada in preference, whenever possible. Our motto is

“HELP BUILD US, AND WE WILL BUILD YOU UP.”

The Mainer Electric Company, Limited
61-63 Albert Street, WINNIPEG, MANITOBA

THEY WIN ON MERIT

"GALVADUCT" and **"LORICATED"** Conduits are the best known and most extensively used because of merit alone.



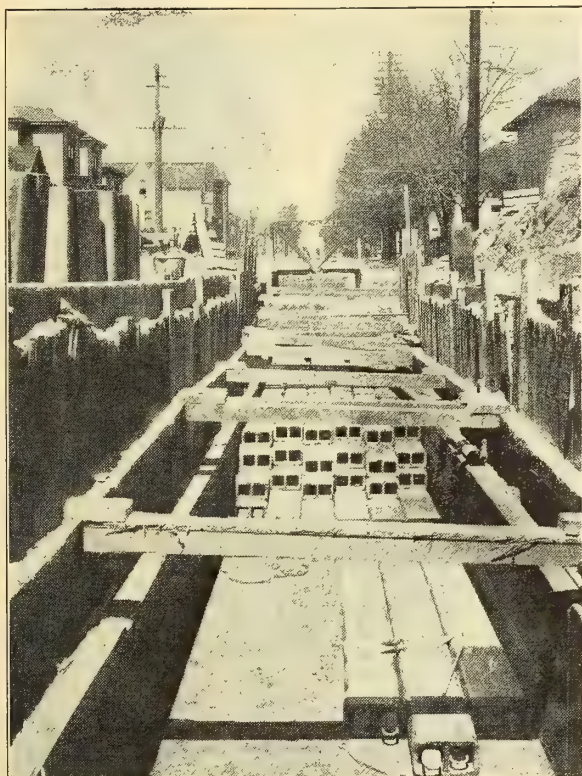
C.P.R. Station, Montreal—a Galvaduct Station

"GALVADUCT"—Zinc coated with an enamelled interior. Well protected from corrosion and with a raceway as smooth as glass. The zinc coating is pure, dense and thick and owing to the mechanical as well as electro-chemical protection pure zinc affords, "GALVADUCT" has the longest life under service conditions to be found in any conduit.

"LORICATED"—A steel tube thoroughly cleaned and coated with flexible enamel. Good protection against corrosion is secured and the thoroughly cleaned and smoothed interior makes easy the insertion of wires.

Samples and Literature by Mail on Request

Conduits Company Limited
Toronto and Montreal

G. M. GEST**Conduit Engineer
and Contractor**

Electrical Underground Conduit Systems

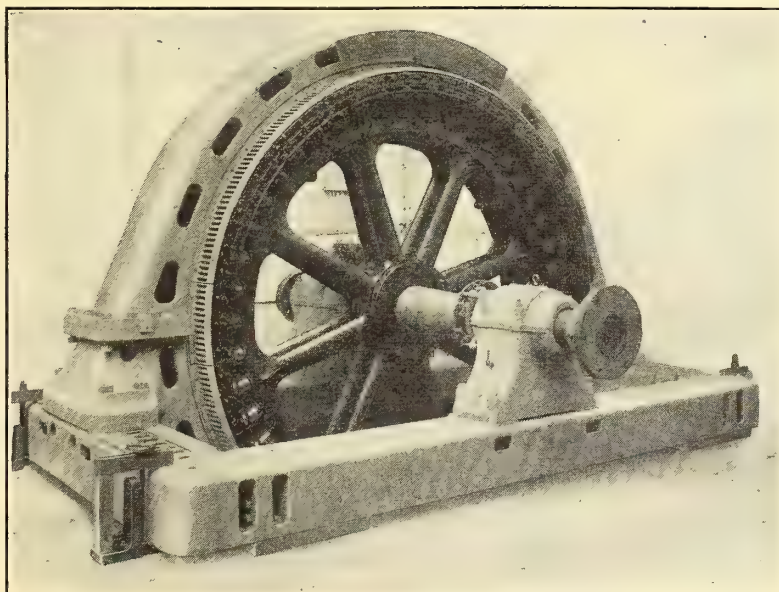
When **G. M. GEST** designs and constructs your Conduit System you receive the benefit of many years' experience and specializing in that line of work.

Power Building, Montreal, P.Q.

VICKERS LIMITED

Patent Automatic Reversing Drive for Planing Machines.

**Complete
Equipments for
the electrical
lighting and
driving of ma-
chine shops,
factories, etc.**



**Turbo
Generators**

—
**Motors
of all types**

—
**Motor
Generators**

—
**Rotary
Convertors**

3000 K.W., 6600-volt, 164 R.P.M. 3-Phase Generator for the City of Winnipeg. Five Generators have been supplied.

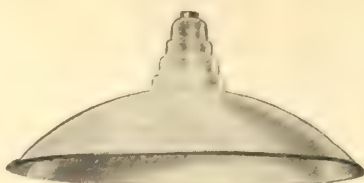
**Head Office for Canada: Lewis Building, Montreal
Mr. J. F. I. Thomas (Representative)**

**Works:
River Don Works, Sheffield, England**



Extensive

Do It!
When?



Shallow Dome

Now!
It's time.



Intensive

How About Some Factory Reflector Business?

Good illumination in a factory is it's most important tool.

Impress this upon the minds of your factory prospects, and tell them that the Holophane-D'Olier factory reflectors are not only the most efficient but also the best made.

A size for every lamp and for every factory requirement.

**Intensive and Extensive Bowl Types, Shallow Domes, With or Without Sockets
All Angles. Holders for All Sockets. Write for Prices and Details.**

The Holophane Company, Ltd., Toronto, Ont.

The Lion M Tungsten Lamps



**The Ideal Lamp for
Business Premises**

Strong, reliable manufacture,
Long Life, More Light all the
the time. Specially adapted
for use in Offices, Stores and
Factories.

TO THE TRADE

We are now ready to fill large or
small orders from stock and make
immediate deliveries and complete
shipments.

Special prices and discounts on
trade orders.

In lots of 1,000 and over, we etch
on each lamp any name or mark re-
quired free of charge.

Samples submitted for testing.

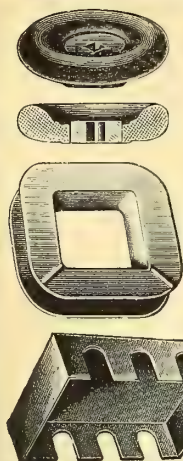
*Special quotations made on request—
write us your requirements*

Electrical Products Company, of Canada

28 Wellington St. West

(Tel. Main 2298)

Toronto



H. WEIDMANN, RAPPERSWIL, SWITZERLAND

Maker of PRESSPAN and INSULATING MATERIAL

PRESSBOARD (Presspan) in Sheets, Rolls and Tapes, Presspan tubes and stampings, Black Presspan.

AMIANITE (vulcanized Asbestos), **Coil Frames, Spools** for Dynamos, Motors and Transformers; Boxes, etc.; Insulating Blocks, Tubes, Plates.

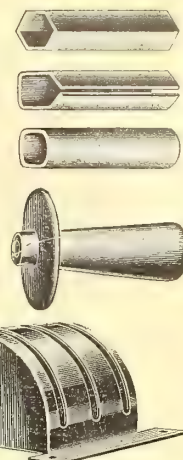
ASBESTOS CEMENT in plates, arc shields for controllers, etc.

CORNITE (high-tension material). Handles for Switch-gear and heating apparatus, controller insulation, moulded parts of all kinds.

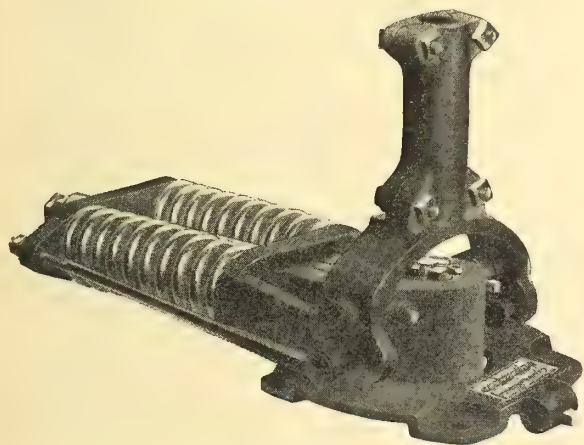
MICA and Substitutes, Insulating Pearls, Transformer Spools

Japanese Paper in Rolls and tapes. Oil-varnished Linen, Silk and Paper.

Insulators for Electric Furnaces, Tramways, &c., &c.



The Star Roller Bearing Trolley Base



It is worth more, but sells for less than any other Trolley Base.

The roller bearing—one of the strongest features consists of eight especially treated and hardened rolls in a malleable cage, running in a specially treated steel bushing against a 1 5/8" steel centre post, practically indestructible.

The Star Base is of strong construction, simple and very durable. Sold under a guarantee.

Will send sample to any point in Canada, freight prepaid, for a test; to be returned at our expense if not satisfactory.

The Trolley Supply Co.

CANTON, OHIO, U. S. A.

OSH KOSH

On a Construction Tool

is the guarantee of the highest perfection that modern facilities attain in the manufacture of

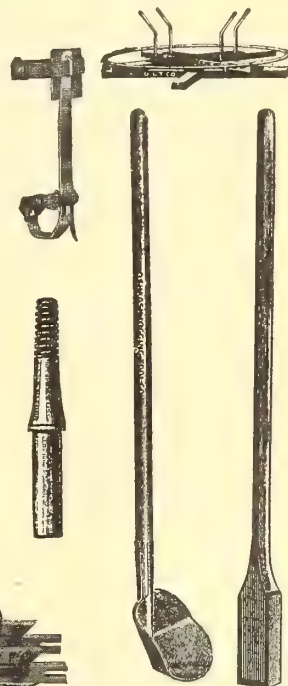
Linemen's Tools

Our catalogue tells the story. **Get one.** It will help to solve the Spring construction riddle.

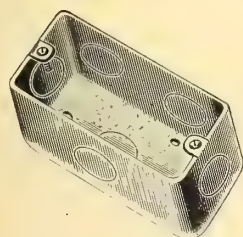
Oshkosh Mfg. Co.

South Main

Oshkosh Wisconsin



"UNION" UNIVERSAL BOX No. 180



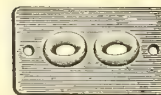
Suitable for Switch or Open Conduit work—having a complete line of Covers for all styles of Attachments, Drop Cord, Fixture, Receptacles, etc.

May we send you a sample?—Write to-day

Chicago Fuse Mfg. Co., CHICAGO NEW YORK

Represented by

Central Electric & School Supply Co., TORONTO, ONT.





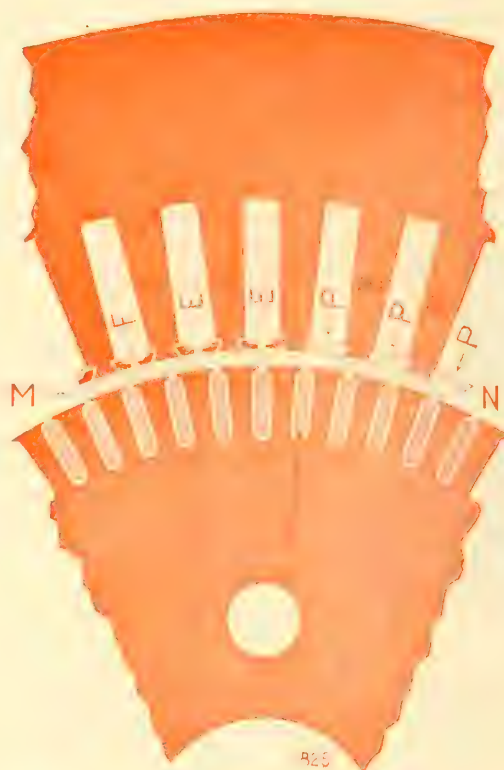
Induction

**Long Life Bearings
High Power Factor
Great Overload Capacity
Conservative Rating**

The manufacturers of induction motors may be divided into two schools:

Those who prefer the "open slot" construction and those who build under the "closed slot" principle. Each of these contends that their extreme is better than the other. The "open slot" advocates sacrifice electrical qualities to mechanical convenience. The "closed slot" adherents gain the highest electrical advantages, but have a motor which is very inconvenient mechanically.

By means of the special arrangement of the end-rings shown in the illustration, connections of uniform electrical resistance are provided, and all tendency toward local heating or concentration in one ring is avoided.



Motors

Generators

Transformers

Motors

**Extra Strong Starting Torque
Unusually Heavy Insulation
Convenience of Repairs
Efficient Ventilation**

In the C. W. motor the slots are first made open, allowing plenty of space for the inserting of heavily-insulated form-wound coils, and are then closed by magnetic wedges which give all the electrical advantages of "closed slot" construction. The cut shows how the magnetic wedge "E" increases the distributing area of the tooth and allows the flux to travel a shorter path than is the case where the word-wedge "P" is used.

For a further discussion of this subject and other interesting advantages of these motors write for induction motor booklet "E."

The C. W. motor has more bars in the rotor than any other similar motor. This results in minimum flux leakage and high torque. This is why it takes a greater overload to stop a C. W. Motor.

Canadian Crocker - Wheeler Co.

Manufacturers and Electrical Engineers

LIMITED

HEAD OFFICE AND WORKS: **ST. CATHARINES, ONT.**

BRANCH OFFICES: **MONTREAL, QUE.
TORONTO, ONT. VANCOUVER, B.C.**

W. T. GLOVER & CO., LTD.

ELECTRIC WIRE & CABLE MAKERS



GLOVERS DRUM MAJOR.

CANADIAN HOUSE:
207 Lumsden Building, Yonge St., TORONTO, ONT.

HEAD OFFICE AND WORKS:
TRAFFORD PARK, MANCHESTER, ENGLAND

MURRAY PATENTSMURRAY PATENTS

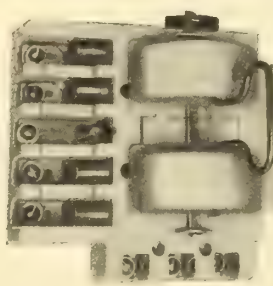
METROPOLITAN Protective and Meter Testing Devices

Combination Service and Meter Testing Cut-out

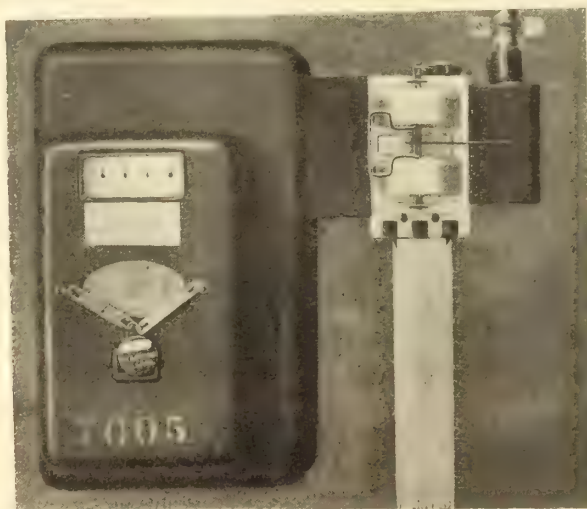
**Metropolitan
Devices**
provide a
**Safe
Reliable
and
Rapid**
means for
**Testing
Meters**



Capacity to 30 Amps



Capacity to 100 Amps



General Electric Type No. D-3 Polyphase Watthour Meter equipped with Metropolitan 3 wire enclosed meter testing and service cut-out No. 151 switch fuses. Type No. D-3 non-metallic meter frame, Type "B" Terminal Protector, Type "M" Seals, wing nuts and name plate, under service condition.

**Continuity
of the
Customers
Service
is
Assured
by using
Metropolitan
Devices**

Metropolitan Engineering Company

Office and Works: TORONTO, CANADA

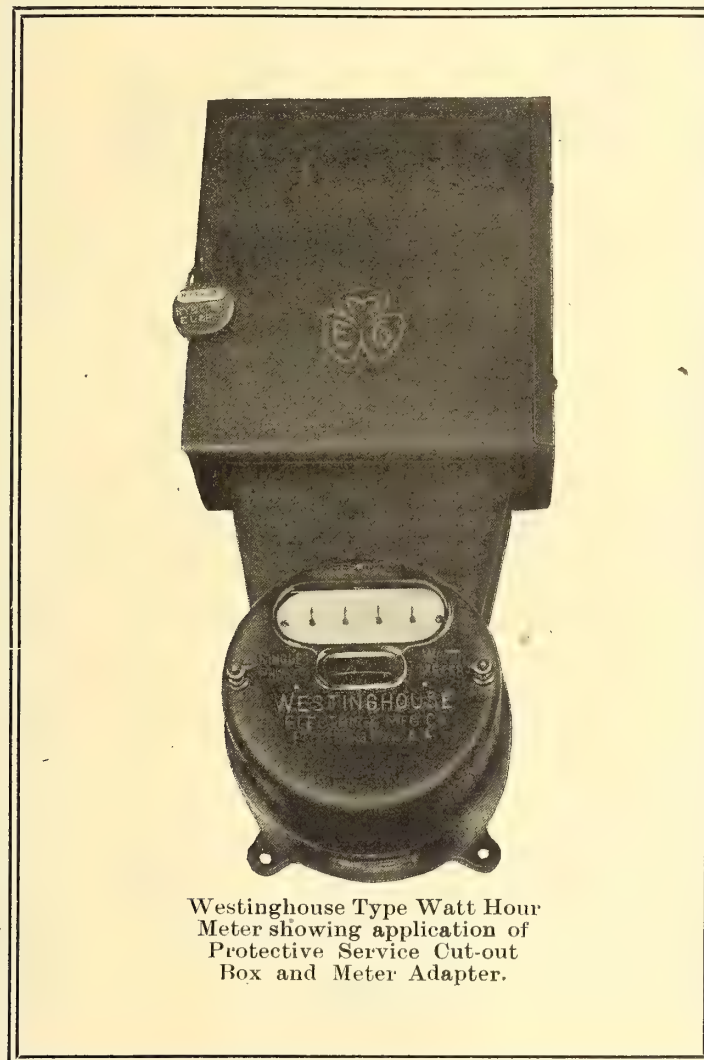
MURRAY PATENTSMURRAY PATENTS

MURRAY PATENTSMURRAY PATENTS

METROPOLITAN Protective and Meter Testing Devices

Protective Service Cut-out Box Meter Testing Device and Meter Adapter

**Safety
Protection
and
Convenience**
are the three
Characteristics
of the
**Metropolitan
Protective
Devices**



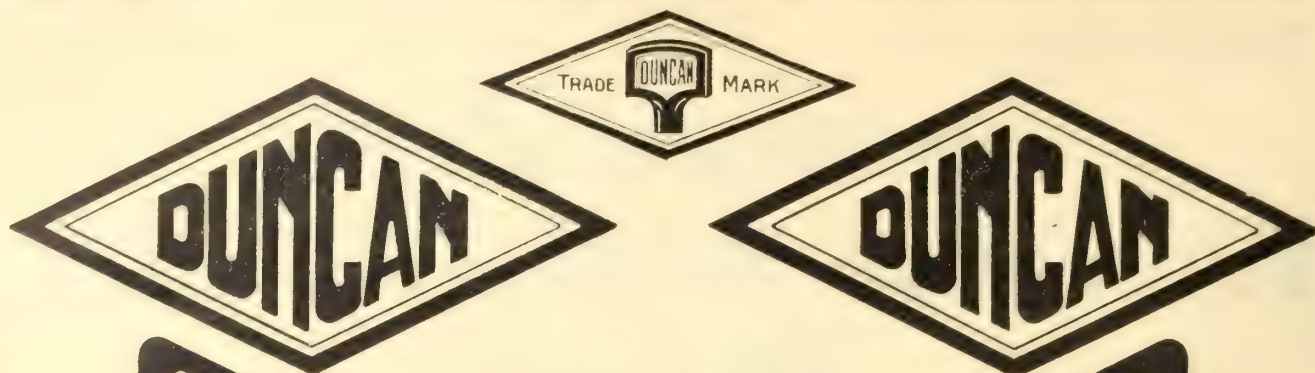
Westinghouse Type Watt Hour
Meter showing application of
Protective Service Cut-out
Box and Meter Adapter.

**Combination
Service and
Meter-Testing
Cut-outs
Terminal
Protectors
and
Meter Frames**
are Illustrated
in our Descriptive
CATALOGUE
Mailed Free upon
Request

Metropolitan Engineering Company

Office and Works: TORONTO, CANADA

MURRAY PATENTSMURRAY PATENTS



Quality and Service

are the two prime reasons
which we emphasize as to
why you will be entirely satisfied
with our supplies.

Our reputation has been built
on "Duncan Quality" and "Duncan
Service" and will be retained on these
same foundations.

*Our new catalog will be ready in
a few days. Send for one for
your files.*

The
Duncan Electrical
Company, Limited
MONTREAL

**Makers of Electrical Supplies
bearing this trade mark.**



No. 1695 (1/2 Full Size)



CANADA



No. 1851 (1/2 Full Size)

The New Hubbel Plug "Fifty-8-Fifteen"



**The Smallest Separable Plug
for the Biggest Service**

NO Plug near its size can do so much. No Plug twice its size can do any more.

Measures $1\frac{1}{8}$ inches from base end to cap top. Cap extends about $\frac{1}{2}$ inch from lamp socket.

Contacts embedded in a one-piece porcelain base. No live parts are exposed when connecting or disconnecting.

Cap made of non-breakable composition. Contact blades have rounded ends and notched edges, which are gripped by stiff springs in the base.

Cap and base go together with a click, hold securely never stick. Push-in cap prevents twisting of the cord when making connection.

You must see and test "Fifty-8-Fifteen" to know how much goodness can be packed in a small plug. If you wish a Sample Free, write today. Use your business letter-head.

R. E. T. PRINGLE

TORONTO MONTREAL WINDSOR

Electrical Supplies

**Street Railway Material
Lighting Standards**

**Fibre, Pressboard, Leatheroid,
Insulating Material, "Hot
Point" Irons, Heating Appli-
ances, Fans.**

"P. & S Shurlock Sockets"

Dawson & Co'y Limited

MONTREAL :: :: WINNIPEG

Electrical Supplies and Apparatus

"Devoe" Iron Form Boxes

The Cheapest and Best



We carry the largest stock of form boxes in Canada.

We have now in stock the following sizes :

6 x 16 x 4	10 x 18 x 5
6 x 8 x 4	18 x 18 x 5
10 x 12 x 4	18 x 24 x 5
12 x 12 x 4	18 x 30 x 5
12 x 18 x 5	9 x 16 x 4
12 x 24 x 5	7 x 22 x 5

Write to-day for Detail Circular and Prices

The Devoe Electric Switch Company

Office and Factory: 157 Craig Street West, MONTREAL

Public Service Corporations

desiring to finance their needs by the sale of Bonds are requested to communicate with us.

We deal extensively in the bonds of Hydro-Electric Power Companies, Electric Railways, Gas Companies and Electric Lighting Companies which meet our requirements.

E. H. Rollins & Sons

Investment Bonds

200 Devonshire St.

Boston, Mass., U. S. A.

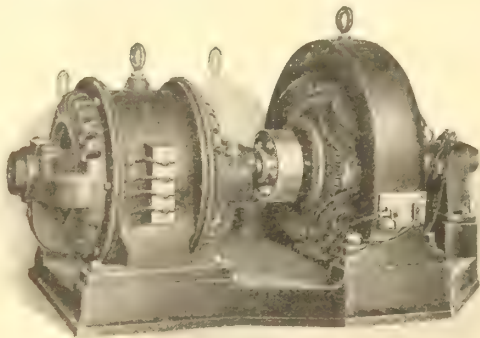
**We Purchase Outright
entire issues of bonds
on steam and elec-
tric railroad, gas,
electric and
hydro-electric
properties.**

N. W. HARRIS & CO.

Established 1882
Incorporated 1911

35 Federal Street, Boston, U.S.A.

Special Machines



When in need of any special electrical apparatus, or repairs to defective motors or generators, write us.

We are fully equipped.

**Toronto & Hamilton
Electric Company**
HAMILTON

Electrical Supplies of every Description

A few of our specialties :

Moloney High Efficiency Transformers

Carbon and Tungsten Lamps

**Rigid and Flexible Conduit
Condulets**

Large stock ; prompt shipments.

Write for new and complete catalogue No. 3.

**Central Electric & School
Supply Co., Limited**

36 Adelaide St. West, Toronto

Only Six Parts!

Think of it—a Frog with renewable tips having **ONLY SIX PARTS!**

A single machine bolt used—*no nuts*. Tips clamp securely upon wire by cam action (see "A" and "B," Fig. 2.) Ample clearance for trolley wheel in pan—Smooth under-run. Can be installed *much quicker and easier*

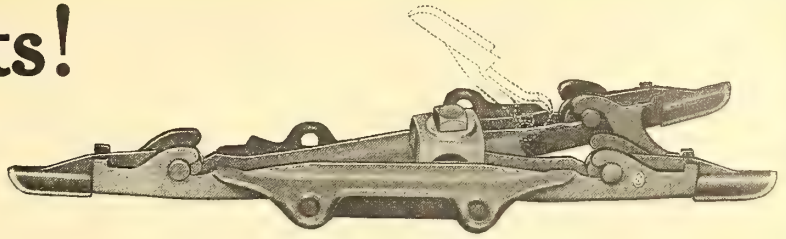


Fig. 1—Type D Trolley Frog—Patent Applied For

than any other Frog.

Wire protected at "C," Fig. 2, from arcing.

Made in all bronze or with malleable pan and bronze tips. See pages 170-172 of Cat. No. 12.

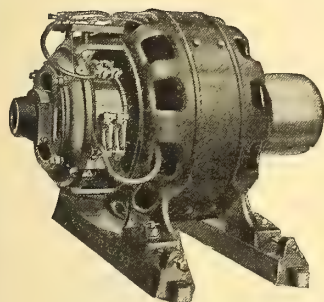


Fig. 2—Showing Cam Action of Renewable Tip

The Ohio Brass Co.

Mansfield - Ohio

New York	-	-	-	30 Church St.
Pittsburgh	-	-	-	306 Fourth Ave.
Chicago	-	-	-	343 So. Dearborn St.



A Type "C" Motor

Holtzer Cabot Motors

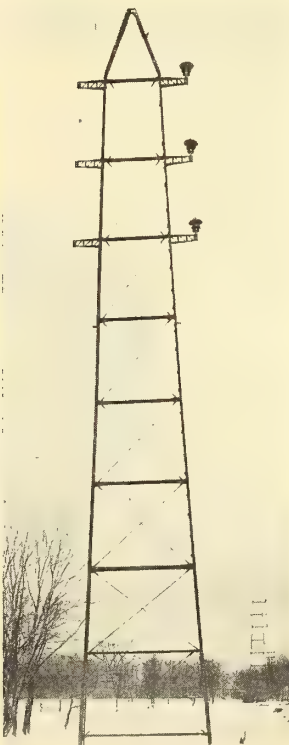
Many Types for Many Purposes

LET US PRESCRIBE FOR YOU

Bulletin 300	Type	"M"	Direct Current Generators
" 304	"	"ST"	Single Phase Motors
" 306	"	"M"	Plating Dynamos
" 314	"	"C"	Direct Current Motors and Dynamos
" 316	"	"LM"	Direct Current Motors
" 317	"	"K"	Direct Current Motors
" 318	"	"CL"	Slow Speed Motors D.C.
" 320	"	"QP"	Polyphase Motors
" 329	"	"AL"	Slow Speed "AC" and "DC" Motors
" 330	"	"QS"	Single Phase Motors
" 331	"	"QD"	Direct Current Motors
" 333	"	"QPW"	Variable Speed Polyphase Motors
" 335	"	"Q"	Alternating Current Generators

THE HOLTZER-CABOT ELECTRIC CO.
BOSTON - CHICAGO

Steel Transmission Structures



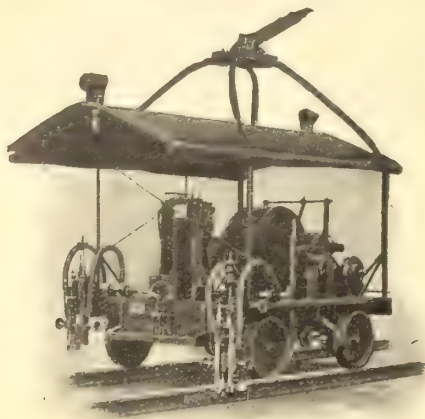
□ The cut shows the type of flexible "A" frames recently erected for a 34 mile line from St. Catharines to Hamilton. These are 47 feet high and 9 feet wide at the ground. Placed approximately 400 feet apart along the line.

This line has worked out at a cost very little in excess of a wooden pole line. If you have a new transmission line to build or a wooden pole line to rebuild, write us.

**Archbold Brady
Company**

Engineers and Contractors
Syracuse : : N. Y.

Electric Weld Rail Bonds



The conductivity of Bonds installed by our process can never be impaired by moisture or corrosion.

When once installed, they are on to stay and cannot be removed without actual mutilation and considerable hard work.

Write for Booklet

The

Electric Railway Improvement Co.

Office and Works, 6005 Carnegie Avenue
CLEVELAND

A Battery Made in the West

will reach Western consumers much fresher and active than imported or Eastern-made batteries. There lies the whole secret of the preference shown by the West for

X CELL DRY BATTERIES

(Made in Winnipeg)

No cell reaches a dealer over five days old. Each and every cell shows high initial amperage, possesses strong powers of recuperation, and is good for long service.

ELECTRIC FLASHLIGHTS

These goods will prove fast sellers when properly displayed. The demand will surprise you, and the profits make the trade worth while. We carry best lines only and quote lowest prices. Write us at our factory.

Canadian Carbon Company
of Winnipeg, Limited

Bury and Irish Ave., WINNIPEG

E. W. HANNA, President and Managing Director



FERRANTI LIMITED

ELECTRICAL and
GENERAL ENGINEERS

Manufacturers of A. C. & D. C. Switch Boards

Ammeters

Voltmeters

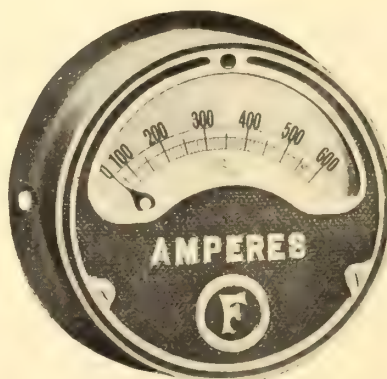
Wattmeters

Frequency Indicators

Power Factor Indicators

Both Switch Board and

Portable Types



Instrument Transformers

Three Phase Pole and

Station Transformers

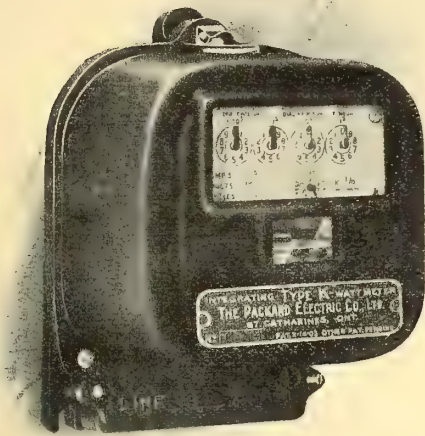
Send for T Lists

WEST TORONTO

G. C. ROYCE

WINNIPEG

Canadian Manager



TYPE K METAL CASE

PACKARD METERS

For All Circuits

Always Reliable

Permanent Accuracy

Every Meter Guaranteed



TYPE PK POLYPHASE

Large Stocks at St. Catharines and Winnipeg

St. John Railway Co., St. John, N.B.

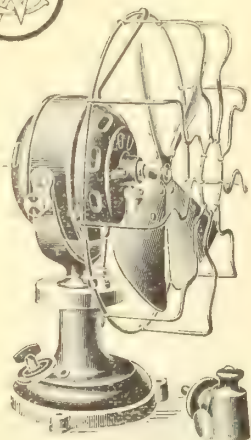
General Supplies, Limited, Calgary, Alta.

The Packard Electric Company, Limited

Factory: ST. CATHARINES

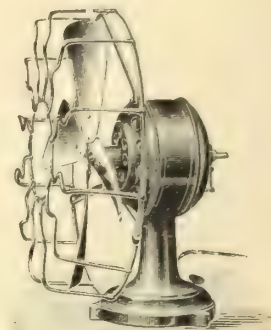
General Sales Office
901-902 Traders Bank Building,
TORONTO

N. W. Office and Warehouse
WINNIPEG



Noiseless Running

FANS



The tremendous sales of C & W Fans stand as a tribute to their good qualities. C & W Fans are manufactured by the largest exclusive fan manufacturing company in the world. Each C & W Fan Motor is furnished with 6 feet of cord connection.

Write for our Stock and Price Lists. Orders shipped immediately from stock for both A C and D C Fans.

Chapman & Walker, Limited

Head Office : 69 Victoria Street, TORONTO, ONT.



MONTREAL, QUE.
406-407 St. Nicholas Bldg.

Branch Offices :

WINNIPEG
395 McGreevy Block

VANCOUVER
Imperial Block

PORCUPINE
J. P. Bartleman



V. I. R. Cables

Wire, Flexible

Paper Insulated
Lead Covered
Cables

Telephone Cables



.075 sq. in. three core, circular
lead covered, steel tape
armoured cable

MONTREAL AGENTS:

Alexander Macpherson & Son,
Montreal, Que.

Vulcanized Bitumen Cables

Transmission
Lines

Trailing Cables

TORONTO AGENTS:

Chapman & Walker, Limited
69 Victoria Street
Toronto, Ont.

W. T. Henley's Telegraph Works Co. Limited

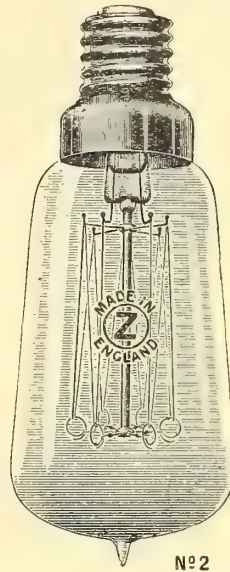
Contracts taken for complete Cable Systems installed



Lamp Satisfaction



The "Z" Lamp Cannot Blacken



LONG LIFE

is another "Z" Lamp virtue, 1,500 hours at $1\frac{1}{4}$ watts per candle is a conservative estimate, and in many cases the average length of life has been greater.

Write for Illustrated Booklet and Stock List.

Chapman & Walker

ENGINEERS AND CONTRACTORS

Head Office: 69 Victoria Street, Toronto, Ont.



MONTREAL, QUE.
Branch Office
406-407 St. Nicholas Bldg.

WINNIPEG
150 Princess St.

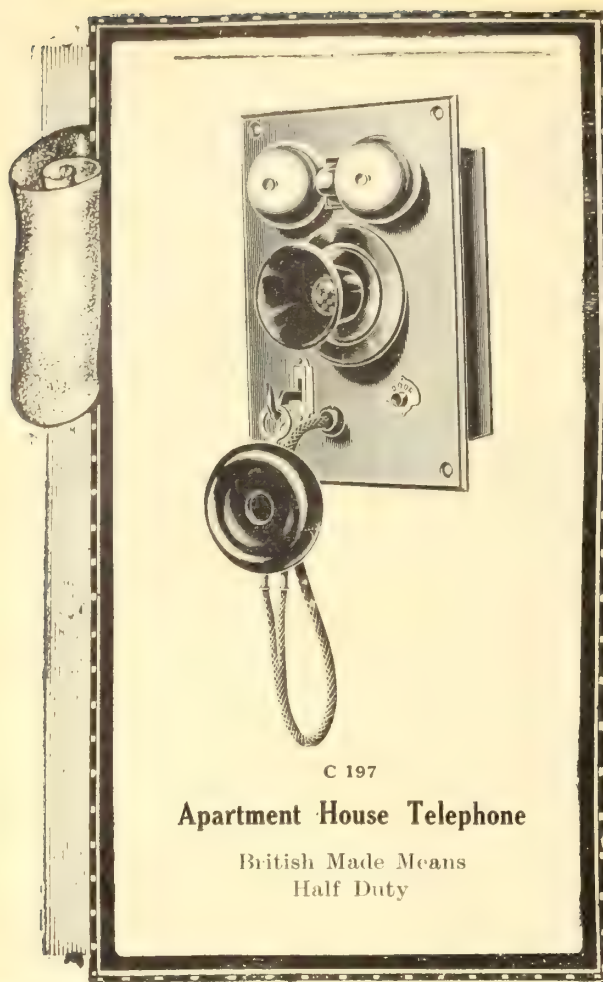
VANCOUVER
Branch Office
Imperial Block

CALGARY
General Supplies, Ltd.
1233 Second S., E.

PORCUPINE
J. P. Bartleman



Stock Carried in Montreal, Toronto, Winnipeg, Calgary and Vancouver



STERLING TELEPHONES BRITISH MADE

AGENTS (With Stock.)

MANITOBA :—The James Stuart Electric Co., Ltd.,
Winnipeg.

ONTARIO :—Chapman & Walker, Ltd., Toronto.

SASKATCHEWAN :—Northwestern Electric Ltd.,
Regina.

BRITISH COLUMBIA :—Cope & Sons, Vancouver.

ALBERTA :—General Supplies, Ltd., 1233 2nd Street
East, Calgary..

QUEBEC :—stocks kept by Dawson & Co. Ltd.,
Montreal; Mechanics Supply Co., St. Paul,
Quebec, (Que.)

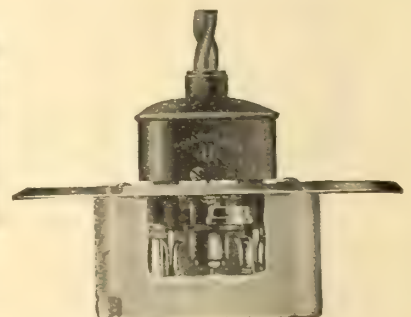
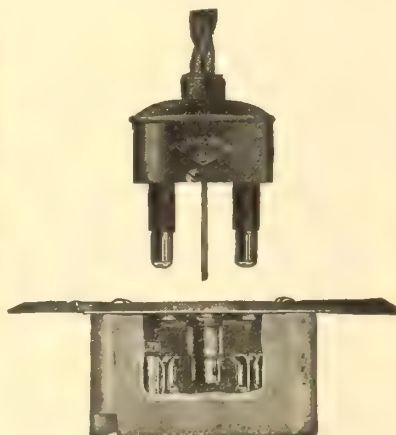
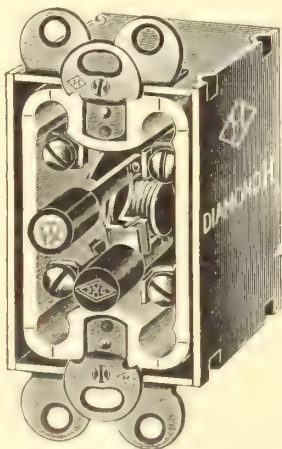
NOVA SCOTIA :—stocks kept by J. Starr,
Son & Co., Ltd., Halifax.

Protect Your Investment in Switches by Specifying "Diamond H"

The best protection for the user because they are dependable in operation. The safest investment for the dealer, engineer or contractor because they give satisfaction.



The "Diamond H" on a switch is valuable insurance—assurance that quality, materials and competent workmanship are embodied to perfect production.

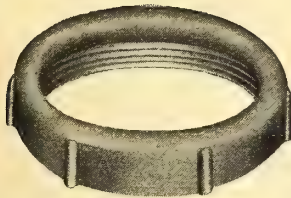


MANUFACTURED BY THE HART MANUFACTURING CO., HARTFORD, CONN.

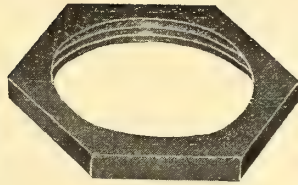
Canadian Sales Agent

C. W. Bongard, Toronto, Canada

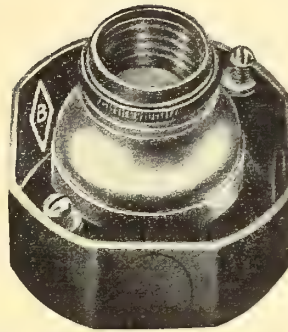
Electrical Supplies



1 1/4" Bushing



1 1/4" Locknut



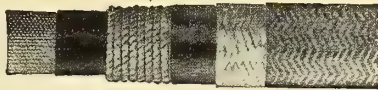
No. 6350-Box and Receptacle



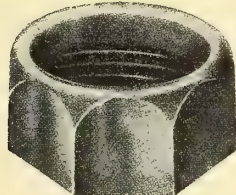
No. 1915-Box and No. 3719-Cover



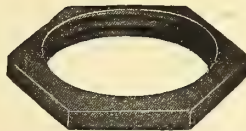
1455-Reversible Guard



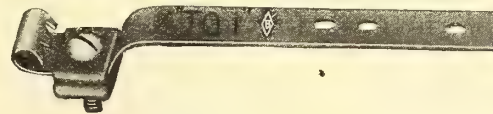
Alphaduct



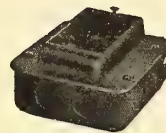
1/2" Bushing



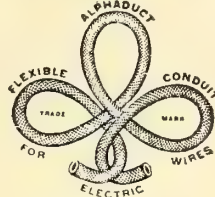
1/2" Locknut



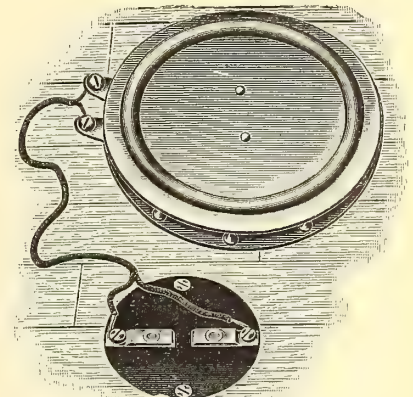
1/2 to 1" Grounding Clamp

81 A 3/8
Fixture, Stem

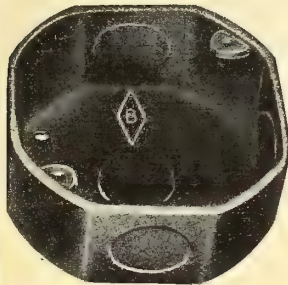
No. 1915-Switch Box



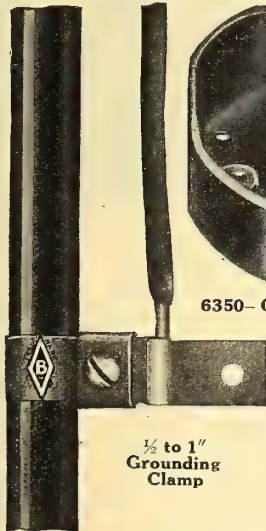
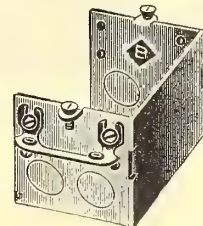
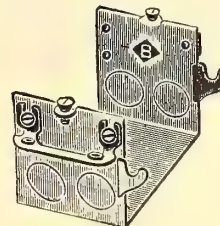
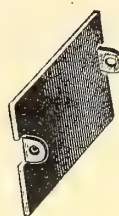
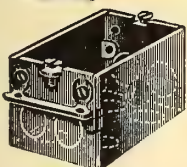
Alphaduct 1/4"



1150-Floor Tread



6350-Outlet or Junction Box

1/2 to 1"
Grounding
ClampS. C. Deep Sw. Box and Spacer
Side comes off and does away with carrying two gangs

C C S. I. Switch Box

Electrical Fittings Co. Limited

70 King Street West, TORONTO, Canada

British Columbia Agents, Cope & Son Ltd., 132 Water St., Vancouver, B. C.

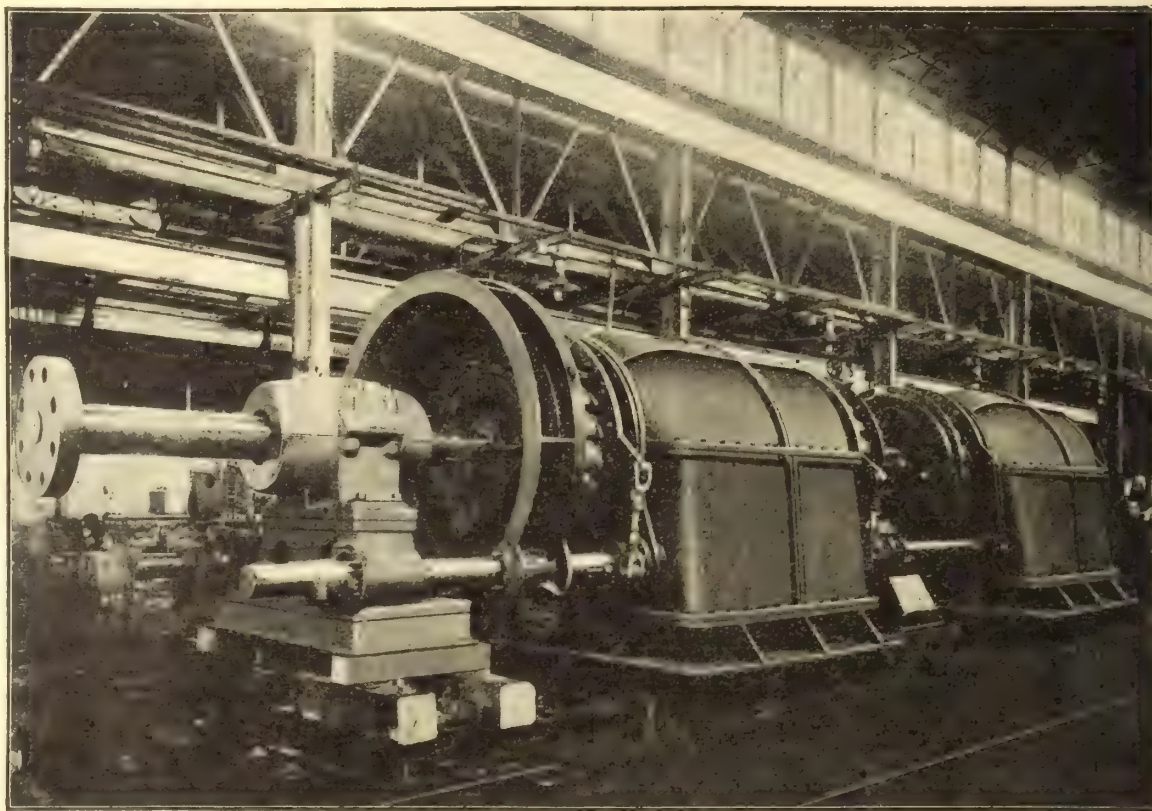
"Made in Canada"

Write for Catalogue No. 3. If your Jobber cannot supply, write us.

Hydraulic Turbines

Specially designed to suit the conditions of operation

☛ Note the strong regulating shaft and the heavy, substantial construction of this unit



**Horizontal Quadruplex Turbine
In Open Flume**

5,350 H. P.

50 ft. Head

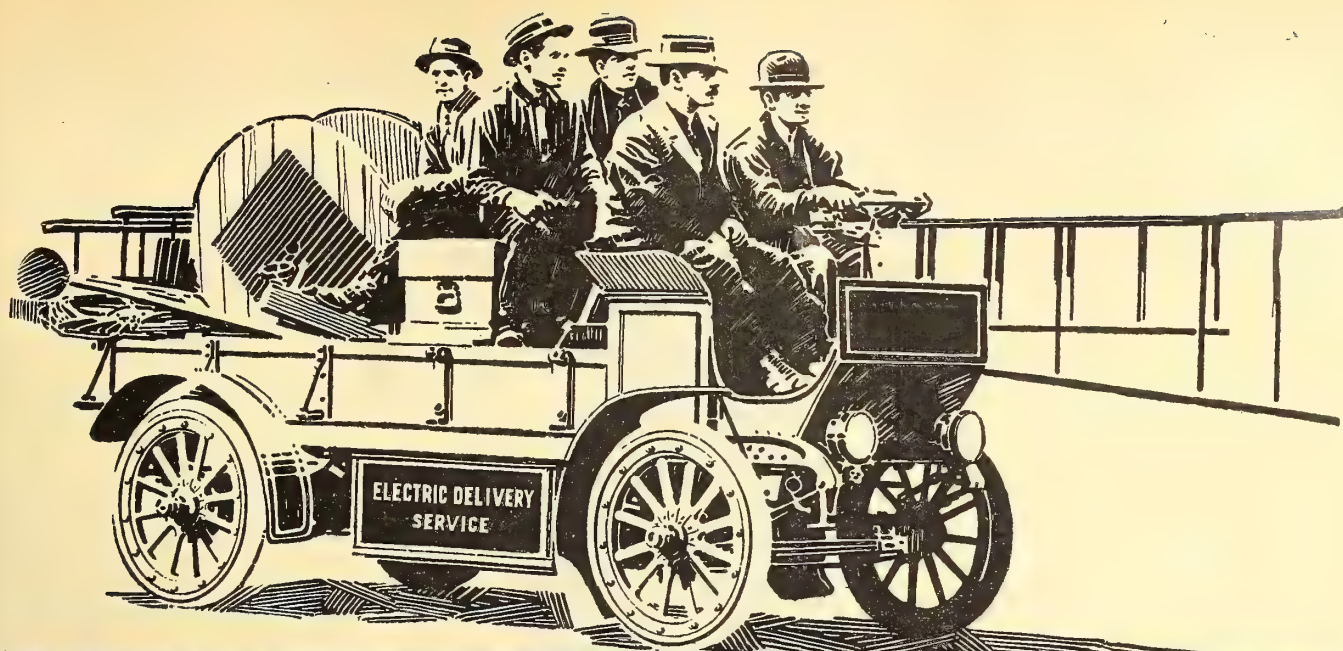
237 R. P. M.

WORKS

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LIMITED**

Sales Offices: Montreal, Toronto, Cobalt, Winnipeg, Calgary, Vancouver.



The purchase and use of at least *one*
Electric Vehicle is an important first
step in any Central Station campaign.

Your use of Electric Vehicles, Mr. Central Station Manager, is the most compelling endorsement of their economy and efficiency.

How can you expect to convince *others* of the desirability of Electric Vehicles if *you* are not using them yourself?

In the work of delivering lamps, setting poles, handling line constructions, carrying men to and from jobs remote from the plant, installing meters, inspecting and maintaining street-lighting equipment, reading meters located at scattered points, thawing out frozen pipes and repairing damages to the overhead or underground system, the Electric Vehicle stands ready to render *greatest* service at *least* expense.

And the records you keep as to mileage, energy consumption, service and cost of operation are invaluable when dealing with prospective customers. This is what the progressive Central Station is doing.

We are conducting a nation-wide advertising campaign for the Electric, both pleasure and commercial, in a great number of national magazines and a long list of trade journals. We want every Central Station in the country to derive the greatest possible amount of individual benefit. We will gladly show you how you can link our national advertising to your local conditions, at little expense. Why not write today?



ELECTRIC VEHICLE ASSOCIATION OF AMERICA

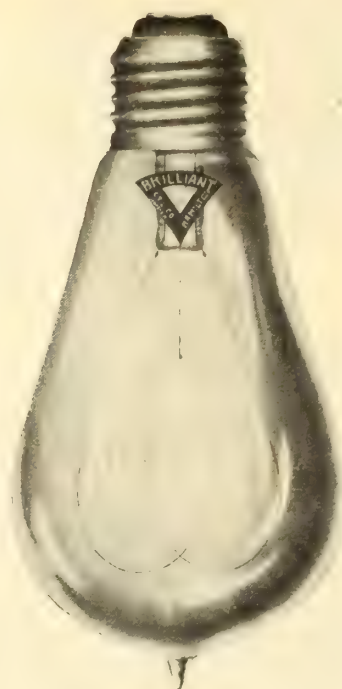
BOSTON

NEW YORK, 124 W. 42nd St.

CHICAGO

(16)

A First Quality
Specification
Carbon Lamp



Exceptional Finish
Close Prices
All Types

NEW TYPE

Brilliant Carbon Lamp

Sold to all the Principal Railroads, the Leading Jobbers and the Largest and Most Important Power Houses; and this branch of our business is constantly growing;

Dainty Electric Glass Shades

AT WONDERFULLY CLOSE PRICES

Tiffanies! Venetian! Decorated! Alabaster! Etched!
Pearlite! and Cheaper Lines!

PROMPT SHIPMENTS FROM STOCK

The Canadian Tungsten Lamp Company

Lighting Experts

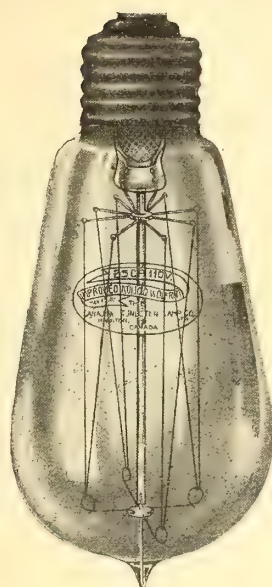
Limited

HAMILTON - - - ONTARIO

Efficiency !

Long Life !

Ruggedness !!



Quality !

Prompt Deliveries

Service !!

DRAWN WIRE Kolloid-Wolfram TUNGSTEN LAMPS

WE GIVE ABSOLUTE PROTECTION

Our Manufacturing Rights were obtained from Original Patentee!!!

The Kolloid-Wolfram was the first Tungsten Lamp sold in Canada.

The Drawn Wire Kolloid-Wolfram is the evolution of the Original Lamp and enjoys undoubtedly the Largest Sale of any Tungsten Lamp in Canada.

BRANCHES: Montreal—30 St. Dizier St., J. W. Moncur, Manager. Winnipeg—56 Albert St., A. L. Woolf, Manager.

Toronto—342 Yonge St., L. E. Harp, Manager.

AGENCIES: Vancouver—6086 Granville St.

Newfoundland—St. Johns, Walter Clouston

New Brunswick—St. John, T. McAvity & Sons.

Victoria, B. C.—911 Government St.

Quebec, P. Q.—Mechanics Supply Company.

The Canadian Tungsten Lamp Company

Lighting Experts

HAMILTON

ONTARIO

Limited

THE SUNBEAM

**Drawn Wire "MAZDA" Lamp is
a Real Lamp with Real Results**

Chemically pure Tungsten metal actually drawn in the form of Wire composes the Filament of **Sunbeam Drawn Wire "MAZDA" Lamps** making them as rugged as the present Carbon Lamp.

Sunbeam Mazda Carbon and Gem Lamps
Have Often Been
Imitated but Never Equalled

The Label is the Guarantee of **QUALITY**

If Your Jobber Cannot Supply You Write Us

MADE IN CANADA BY
The Canadian Sunbeam Lamp Co.
Limited

Main Office and Factory:
Dufferin and Liberty Streets
Toronto

Northwestern Office and Warehouse:
173 McDermott Avenue
Winnipeg



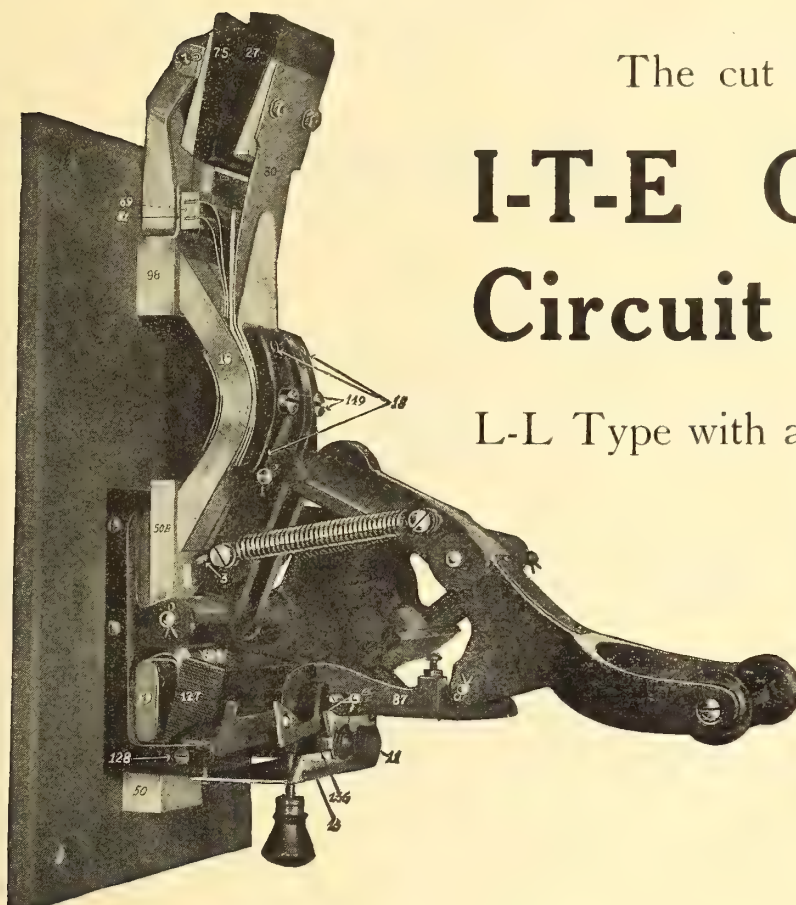
Perhaps no one piece of electrical apparatus is more widely used than the I-T-E Circuit Breaker. Certainly none has a higher reputation for effectiveness and reliability.



The cut illustrates an

I-T-E Overload Circuit Breaker

L-L Type with a part of the housing removed, showing the admirable simplicity of the working parts.



For more detailed information as to this and other types of I-T-E Circuit Breakers see the new I-T-E CIRCUIT BREAKER HAND BOOK.

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 H. F. Darby, Jr., 1501 Monadnock Block, Chicago, Ill.
 H. W. MacVaugh, 1122 Park Building, Pittsburgh, Pa.
 Thos. E. Beasley, 751 Ellicott Square, Buffalo, N.Y.
 C. E. Wise, 427 Ford Building, Detroit, Mich.
 Eccles & Smith Co., 71 First Street, San Francisco, Cal.
 Eccles & Smith Co., 524 S. Los Angeles St., Los Angeles, Cal.
 Eccles & Smith Co., 68 First Street, Portland, Ore.
 Electric Manufacturers' Sales Co., Tramway Bldg., Denver, Col.
 I-T-E Electric Co., 72 Finsbury Pavement E.C., London, Eng.



Bare and Insulated

WIRES AND CABLES

in
Copper and Aluminum

RAILWAY FEEDER CABLES

in Copper and Aluminum

Copper Trolley Wire
Copper Clad (Duplex Metal) Wire
Galvanized Steel Strand for Guys

Canada Wire & Cable Co.

Limited

1170 Dundas Street, TORONTO

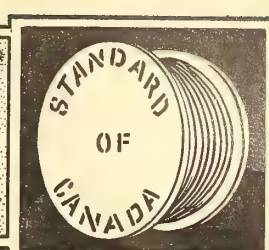
Stock of Wire and Cable Carried in Toronto, Montreal and Winnipeg

SALES AGENTS:

{ Roper, Clarke & Co. Limited, MONTREAL
A. E. Esling, Scott Block, WINNIPEG
Macdonald, Marpole Co. Limited, VANCOUVER



"STANDARD" QUALITY



You Pay for Good Wire

whether you use it or not. If you buy a wire "made to meet a price", you may pay several times the cost of good wire in replacing your defective wiring or the building in which it was installed.

"Sterling" Rubber Insulated Wire

is made to maintain a standard, not to meet a price. The price is, however, as low as that for which a product of equal quality can be successfully sold.

This standard is a self-imposed one because "Sterling" might meet all N. E. C. specifications and tests with a much lower quality than it possesses. A higher quality than required is voluntarily maintained because the slight increase in cost is more than made up by the greater durability and economy secured.

Our new booklet, "STERLING", gives valuable information about rubber covered wire. It will be sent on request.

Standard Underground Cable Co., of Canada, Limited

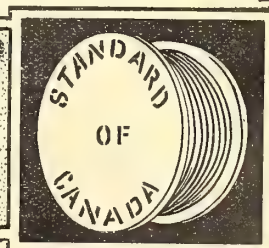
Department E

Hamilton, Ont.

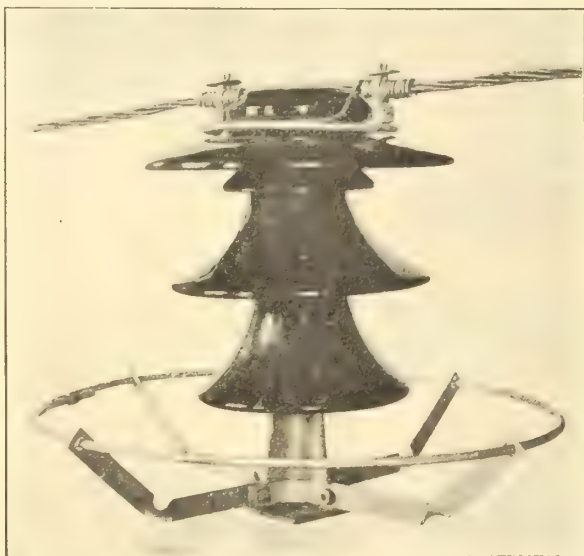
Manufacturers of Electric Wires and Cables of all sizes, all kinds, for all services, also Cable Junction Boxes, Terminals, etc.



"STANDARD" ECONOMY



A Vital Difference



Patented February 25, 1908
April 5, 1910
August 9, 1910

between the Nicholson Arcing Ring and arcing rods or horns or similar good intentions is that one is a ring while the other is not, and the value of the ring construction is this—that a two-mile breeze will hustle the arc around to the lee side of the insulator where its heat is expended in free air, while an arc from a *fixed* terminal, such as a horn or rod, may be blown by that same breeze *under the insulator*.

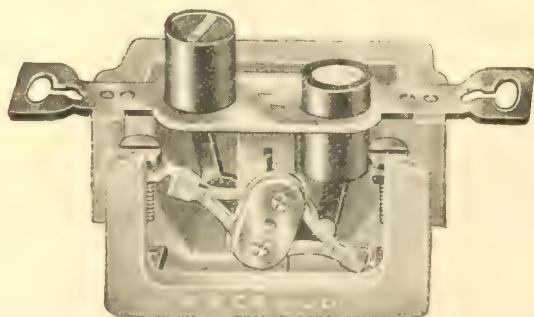
The Locke Insulator Mfg. Co.
Victor, N.Y.
OR
Engineering Equipment & Supply Co.
410 St. James St., Montreal, Que.

“Excello” Switch Specialties

Are built up to a standard not down to a price

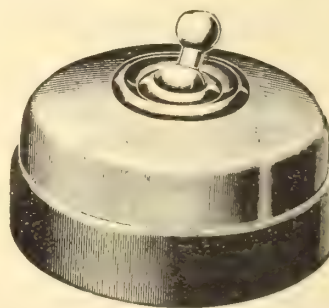
The Excello line of Push Button and Tumbler Switches have been developed with the purpose of giving both the contractor and user absolute satisfaction.

EXCELLO P. B. TYPE



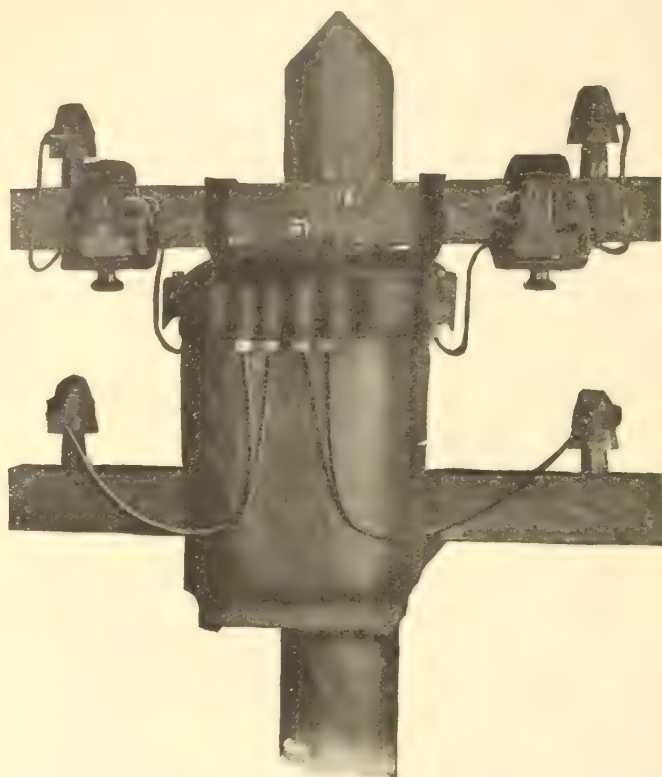
Easy Push and Strong Action
Large contacts and liberal current carrying capacity.

EXCELLO FLAT TYPE

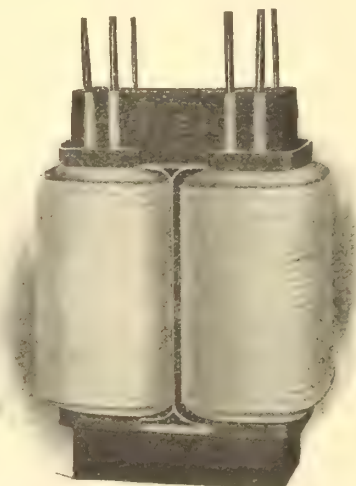


The simple action of an Excello Tumbler Switch is more desirable than the noisy snap action of a Rotary Switch.

Engineering Equipment & Supply Co.
410 St. James Street, MONTREAL



Moloney High Efficiency Transformer in position on pole showing method of wiring



Interior view of Moloney High Efficiency Transformer

High Commercial Efficiency

is the sum total of what is required in transformers—the knowledge that the current is not being wasted in transformation—that the core and copper loss is low with a low temperature rise and a high and permanent insulation—that the construction is strong and the workmanship is faultless. All this is necessary and what is required in transformers. All this is what is given in the highest degree in

Moloney High Efficiency Transformers

Before you decide on the purchase of transformers let us figure out some transformer costs for you. Let us **show you how** Moloney transformers effect a **direct saving** over any other method on account of their high-commercial-all-day-efficiency.

Write for new catalogue giving full data and all information.

Canadian Moloney Electric Co.

Limited

Office and Works: WINDSOR, ONT.

DISTRICT OFFICES:

512 Canadian Express Bldg., MONTREAL
616 Continental Life Bldg., TORONTO

606 Granville Street, VANCOUVER
21 Scott Block, WINNIPEG

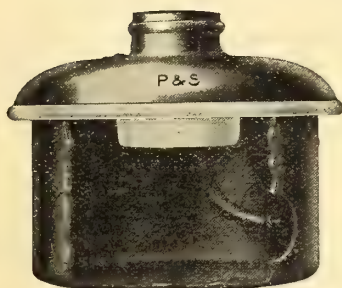
COMPLETE STOCKS:

WINDSOR

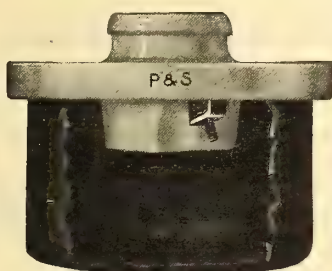
WINNIPEG

VANCOUVER

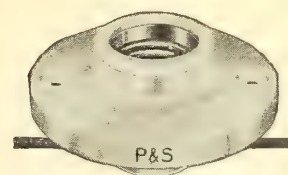
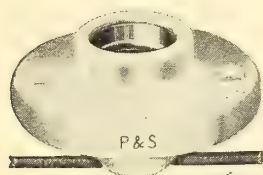
YOU DON'T NEED A COVER



You do not need a cover because P & S Outlet Box Receptacles completely cover the Outlet Box. We manufacture receptacles to suit all conditions, some with porcelain insulating ring, some without, some with open clips and some with rubber covered wire terminals. Some for $3\frac{1}{4}$ " boxes and some for 4" boxes while others may be used on both.



All of the above receptacles together with many more convenient wiring devices, are shown in our new catalogue No. 20, just received from the printers. If you have not received a copy, use the coupon today.



FOR SALE BY ALL JOBBERS

CARRIED IN STOCK BY:

Dawson & Company, Limited	-	Montreal
Central Electric & School Supply Company	-	Toronto
James Stuart Electric Company	-	Winnipeg
Mainer Electric Company	-	Winnipeg
Dawson & Company	-	Winnipeg
Cope & Son	-	Vancouver
A. R. Coutts & Company	-	Vancouver
Mechanics Supply Company, Limited	-	Quebec
St John Railway Company	-	St. John, N.B.

PASS & SEYMOUR, INC.

Main Office and Works:

SOLVAY, NEW YORK, U.S.A.

NEW YORK CITY, 178 Fulton Street SAN FRANCISCO, Rialto Building
CHICAGO, 700 West Jackson Blvd.
DENVER SALES AGENTS—B. K. Sweeney Electrical Co.

Pass & Seymour, Inc.

Solvay, N.Y.

Please send us your catalog No. 20.

Name

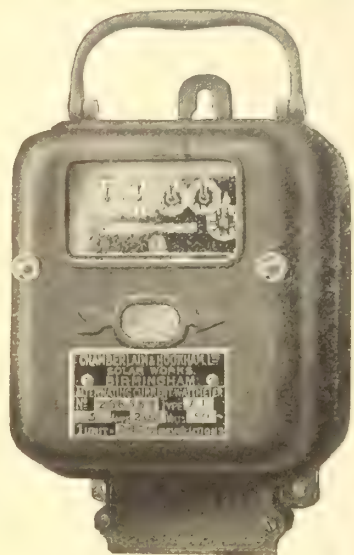
Address

City

State

Coupon No. 40

- C. & H. METERS -



Type "A1."

CABLEGRAMS:
"METERS TORONTO"
TELEPHONE: MAIN 7791

OUR METER has a higher torque and a higher ratio of torque to weight than any other A. C. Meter on the market.

It is supplied with ordinary or cyclometer counters as desired.

Ordinarily, it is supplied in a light cast-iron case which does away with stray-field errors, but it can be supplied in glass case if required.

Besides ordinary meters, we make Three-phase Meters, Two-rate meters, and Prepayment Meters.

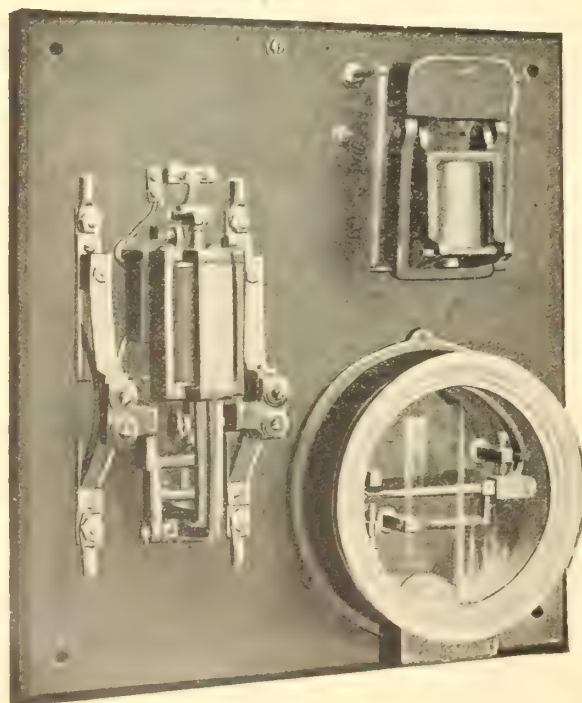
The Chamberlain & Hookham Meter Co.

312 Kent Building, TORONTO

Limited

Meter and Time Switch Specialists

SUNDH PRESSURE REGULATORS



For use in starting A. C. and small D. C. Motors.

Specially designed for installations where they can be thrown across the line without the use of starting resistance. Compact and reliable and will not get out of order.

When the amperes taken by motor exceed the 10 amp. capacity of the magnet switch, a switch of large capacity is added, the magnet switch acting as a relay.

We manufacture a complete line of controlling devices such as Motor Starters, Pressure Regulators, Tank and Sump Switches, Panels, etc.

Send for Catalogue.

Sundh Electric Company
New York, U.S.A.

Represented by C. H. L. Keeler Company, Limited, Toronto, Canada

Install "NOARK" Primary Boxes For Safety's Sake

Transformers need some form of reliable protection and there is no better way to secure this than by installing "Noark" Primary Boxes.

These Boxes are the result of successful development and are in actual service, operating perfectly under most severe conditions.

By reference to the illustrations it will be seen that "Noark" Primary Boxes are made in two styles, viz.:

Bushings on sides or ends — Unions on sides or ends. The three ampere classes are as follows: 1-30, 31-60, and 61-100 amperes respectively.

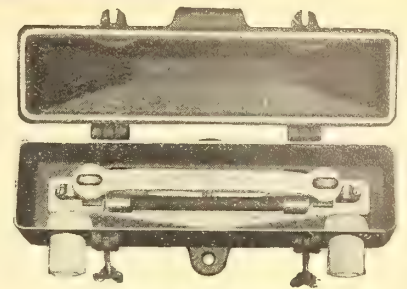
The boxes of each class can be furnished in four ways:

1. Porcelain Bushings on the ends.
2. Porcelain Bushings on one side.
3. "Noark" Kewanee Unions on either end.
4. "Noark" Kewanee Unions on one side.

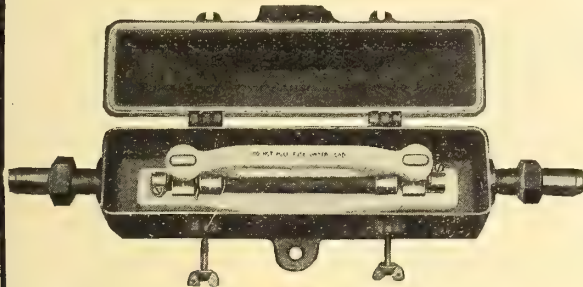
The boxes are in main the same with the exception of cable entrances and fuse sizes.

The cut-outs are mounted in iron boxes with covers securely closed by means of pivot studs with wing nuts. A piece of white ash is used for the cut-out base, impregnated with linseed oil. This is superior to porcelain, fibre or slate and the oil makes it weatherproof. All contacts are well-known "Noark" Thimblelug Type.

Each box has a very high factor of safety and is tested at 10,000 volts before shipment.



"Noark" Single-Pole Fuse Box,
Type "E" 2500 Volts



"Noark" Subway Boxes, 2500 Volts, Type "E" Fuses,
Single Pole.

Write nearest branch as to your requirements

THE CANADIAN H. W. JOHNS-MANVILLE CO., Ltd.

Manufacturers of Asbestos
and Magnesia Products

ASBESTOS

Asbestos Roofings, Packings,
Electrical Supplies, etc.

TORONTO MONTREAL WINNIPEG VANCOUVER

1218

Monarch Electric Company, Limited

St. Lambert, P.Q.

DISTRICT MONTREAL

Phone: Main 3988
Montreal Exchange



500 Amp. 6,000 Volt Automatic
Oil Circuit Breaker Laminated Con-
tacts Individual Oil Tanks. Can be equip-
ped for remote control.

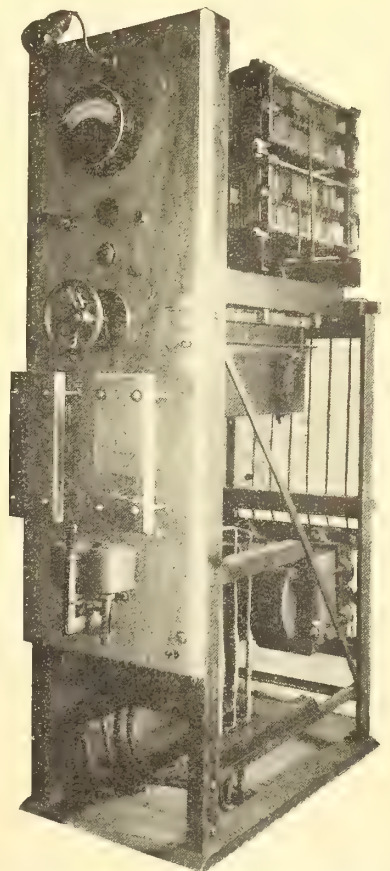
We
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Electrical
Specialties,
Switchboards,
Switches

Special Transformers

and numerous other Electrical Ap-
pliances but space prohibits enlarge-
ing on them in this issue.

300 H.P. 2500 VOLT MOTOR STARTING EQUIPMENT



Three Leaders in Northern Electric Lighting Specialties

HOLOPHANE SHADES



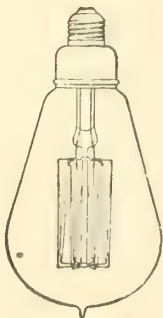
Because of their high brilliancy, absolute purity, delicate pattern and great strength, we recommend Holophane Shades as unquestionably the best on the market.

They are made in many styles and sizes for use in Factories, Offices, Banks, Hotels, Residences, Shops, Shop-windows and for ornamental street lighting.



TUNGSTOLIERS

Tungstoliers possess so many advantages over the ordinary rigid type of fixtures that they are in a distinct class by themselves. They are made of 22 gauge steel and are wired complete ready for installation. The several pieces composing the complete line, permit of a wide range of adaptation and each of the various styles is designed and adapted for all classes of practical, commercial lighting. There is **no turning** of stem in attaching to ceiling, no abrasion of wires. They fold up like an umbrella, they can be carried under the arm.



TUNGSTEN LAMPS

Tungsten Lamps are steadily coming into more general use for every phase of Industrial and Commercial Lighting.

These lamps give about three times as much light as the Carbon Lamp, with the same current consumption and have other advantages, such as giving whiter light and being less sensitive to variation of voltage.



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AND MANUFACTURING CO. LIMITED

Manufacturer and Distributor of Telephone Apparatus, Electrical Supplies and Fire Alarm Apparatus for every possible need



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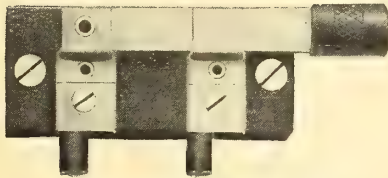


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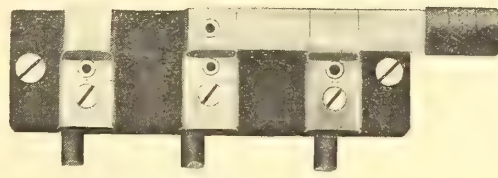
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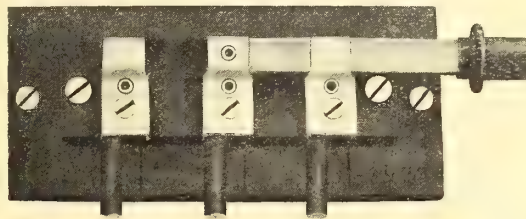


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Battery Switch No. 1011

Our Indestructible Battery and Magneto Switches eliminate trouble, the wire is clamped not placed under a screw. Its the little things that count.



High Tension Magneto Switch No. 1012

Write for sample, it will pay you.

IMMEDIATE SHIPMENTS

The price will surprise you there is nothing to it.



This New Iron Will Stimulate Large Sales

Your sales of

Economic Heating Appliances

will receive an added impetus if you offer **this New Iron**. It is certainly the most perfect model that has ever been produced. All the old drawbacks of earlier models have been overcome. It consumes 20% less energy at a given heat than any other Iron on the market. It will **never** burn out. Rated voltage 110 v. tested for 20 minutes at 220 v. The most serviceable and economical electrical appliance ever made.

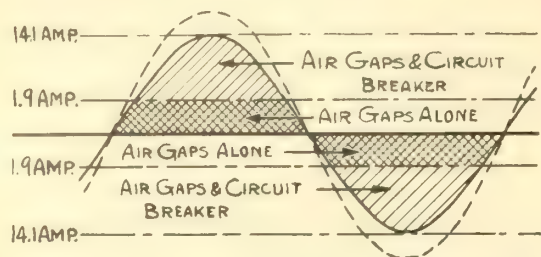
The new electric 3 heat disc stove is most carefully constructed to give the greatest heat at the smallest working cost. It is strongly made and beautifully finished, it will never break or burn out.

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Curve showing Graphically the Functions of the Air Gaps and the Circuit Breaker in the Garton-Daniels Arrestor

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Garton-Daniels Lightning Arrestor

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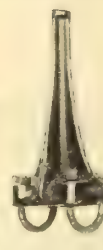
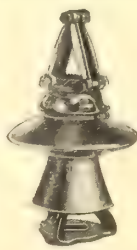
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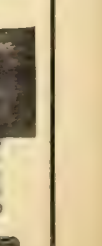
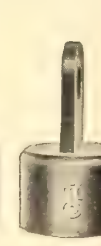
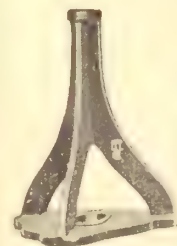
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Equipped with Patent Ground Clamp Device. No expensive wiping of joints. Will eliminate all break downs and outages. Can ship from stock. Send for Catalogues. All bells shipped with filling compound. Bus bar supports for all voltages for round or flat bus. Malleable pins, wall tubes, roof bushings, air and floor boxes. Malleable switchboard and pipe frame fittings. **NOTICE**—We own Canadian Patents No. 126336 and No. 131114 covering all applications of cable bells or potheads,

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Electrical News

Generation, Transmission and Application of Electricity

PUBLISHED MONTHLY BY

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Toronto, October, 1912

No. 10

Interior Wiring Regulations

As noted elsewhere in this issue, the Hydro-electric Power Commission of Ontario has caused to be drawn up and distributed a code of inside wiring rules and regulations which it is proposed to enforce throughout Ontario. This is the outcome of a recent act of the Ontario Legislature investing the Commission with power to draw up, approve and enforce such rules as in their judgment may be suitable for the regulation of inside wiring. Provision is made for the appointment of one or more inspectors in each municipality, by the municipality, who shall have power to enforce these rules.

Any course which has for its object the standardization, improvement and efficient supervision of electric wiring installations will commend itself to electrical workers of all classes, but the machinery the Ontario Government proposes to set in motion would not appear to be the most suitable for the work to be performed. It is very doubtful, indeed, if this is a work for the Hydro-electric Commission at all, but conceding this point for the moment, what was the object in granting the Commission power to draw up a set of rules and then refusing the same body any power of enforcement—for it is plain that the appointment of inspectors by the municipalities takes the matter of enforcement practically out of the hands of the Commission. If the Commission had been given the power to appoint the inspectors, the whole responsibility for satisfactory results would have rested with this body. Under present conditions the way is clear for the appointment of inferior inspectors, since most municipalities do not elect representatives who have the necessary information to guide them in making proper choice of such an officer. If this be true of the ap-

pointments it will be equally true of the work done by the appointee. The result will doubtless be, in many cases, that the rules, admirable in themselves, will be ignorantly or carelessly interpreted, thus rendering the rules and regulations of no effect whatever.

In point of fact, however, we believe the government has made a mistake in granting power to the Commission (and the Commission in accepting it) to have oversight of this class of work which could have been much more efficiently and impartially handled as a separate department or sub-department of the government itself. The Hydro-electric Commission of Ontario is in effect operating a public utility in competition with and along much the same lines as numerous private companies and has no more right to sit in judgment on the installation work of the private companies than the companies have to inspect and criticize the Commission's work. No one will question but that the engineers and electricians employed by the private companies are equally efficient with those employed by the Commission. An anomalous condition has thus been created which will tend to cause friction, and a lack of co-operation on the part of the private companies—a condition not conducive to the efficient enforcement of any set of rules or regulations.

We believe the problem has its solution in the entire matter being taken out of the hands of the Commission and placed under the supervision of a single officer of recognized experience and efficiency who, subject to government control, will have power to specify the inspectors' qualifications, name these inspectors and who will be held directly responsible, by the government, for the proper enforcement of the rules. Such a man, no doubt, is available, and such a course is, we believe, the one best calculated to give the desired results in this very important field of action.

The Illuminating Engineering Society Convention

In the course of half a decade the "Illuminating Engineer" has been transformed out of an unknown quantity into one of the most useful, scientific, enthusiastic and for the most part, appreciated members of the electrical profession. He is the natural answer to the call of the present age for greater efficiency, and during his short existence has probably done more than any other branch of the profession in cutting down ultimate losses and raising overall efficiencies in every form of illumination. The work of the "Illuminating Engineer" must be known to be thoroughly appreciated. It is not a fact, as has been too generally believed, that the illuminating engineer advocates always more light and more expensive fixtures and equipments. On the contrary, it has been scientifically demonstrated, time and again, that over-illumination is as troublesome as under illumination, and that quite as much depends on the proper placing of the units, the use of the proper candle power, the employment of the proper shades, etc., as on the actual quantity of current consumed. In this way many a customer has been able to reduce his bills by the proper arrangements of his lighting units, at the same time getting much more satisfactory results. Another item to be considered too, is the aesthetic effect of modern lighting equipment on the customer no less than his physical improvement resulting from the eyes working always in comfort and under greatly reduced strain.

The strength of the Science of Illumination, as such, is shown by the proportions of the 6th annual convention recently held in Niagara Falls, Ont., of the Illuminating Engineering Society, and by the papers read, which indicate the rapid strides being made towards illumination perfection. A number of these indicated research methods and results of a very important character, both in theory and practice,

among the topics discussed being such as "Reflecting Properties of Various Materials," "Characteristics and Tests of Carbons," "Eye Efficiency Under Different Conditions," "Theory of Illumination Curves," etc., etc.

For practical value, we believe a paper by C. L. Law and A. L. Powell, on "Small Store Lighting," is especially worthy of consideration, as this is a class of work the average contractor lives among and hence needs most information about. A typical store of each class is discussed, the type of installation best suited is given, with the intensity of illumination required. On another page of this issue will be found a lengthy review of this interesting paper.

Plant Efficiency

A most useful paper on the efficiency of the various parts of a hydro-electric generating plant, and distributing system, was recently read before the American Institute of Electrical Engineers by the Chief Engineer of one of the largest United States operating companies. Papers of this type are exceedingly rare and are correspondingly welcome. No doubt the reason few such figures are available for publication is that few companies have the means, or, having the means, go to the trouble, of making extended tests on actually operating equipments. So, we have to be satisfied with the so-called guarantee of the manufacturer. By this we do not mean to insinuate that the manufacturers' tests are not reliable, but it is daily becoming more evident that test conditions in a factory and working conditions when the apparatus has been installed and operating for some time, are quite different and often will give surprisingly unlike results.

According to the figures submitted, the over-all efficiency of this plant is only 39.5 per cent. of penstock input, 60.5 per cent. representing the loss from the instant the water entered the penstock till the energy passed from the meters onto the customers' lines. The greatest loss was shown in the waterwheels, about 38 per cent. being accounted for here as compared with less than 4 per cent. in the generators and about 2 per cent. in each set of high tension transformers. High tension transmission accounted for less than one per cent. of the loss, which would be, of course, greater in proportion as the line length increased. The other losses in smaller transformers, secondary distribution, meters, etc., vary between 2.6 and .18 per cent., the latter representing a 15,000 volt distribution. The writer outlines the methods followed in arriving at the different values and tabulates the results in a summarized table which is also represented graphically. A liberal extract of the paper appears in another page of this issue.

Information Respecting Water-Powers

The Commission of Conservation of Canada are sending out a limited number of pamphlets entitled, "Instructions relating to the gathering of certain preliminary information respecting water-powers." This pamphlet is intended to be a brief suggestive guide to those who are interested in the collection of preliminary data relating to inland waters.

The instructions have been drawn up by Arthur V. White, M.E., and their object has been well outlined in a paragraph in Mr. White's introduction which reads as follows:—

"It is believed that if a little special study is given to the subject of inland waters by those entrusted with the administration, or engaged upon the survey of government lands, such study will evoke in many persons an interest in our water resources, and in turn this will prove to be

a stimulus which will result in the observation and recording of much information respecting water-powers, the acquisition of which information might otherwise be delayed."

Inasmuch as there are comparatively few who would be interested in these instructions or who, if interested, would be of any great service in enabling the government to collect information, only a few hundred pamphlets are available for distribution which will be mailed (only on application) to the secretary, the commission of Conservation, Ottawa, or to the Department of Lands, Victoria, B. C. It is to be hoped that these pamphlets will find their way into the hands of persons who will endeavor to assist our government in the strenuous attempts they are making to tabulate and conserve for the use of the people the water powers of Canada. For, tremendous as these powers will doubtless prove to be, there is no question but that they will not prove any too large for the equally tremendous development which is certain to take place in our Dominion during the next century.

Mr. Pack Goes to Minneapolis

Mr. R. F. Pack, late general manager of the Toronto Electric Light Co., whose resignation was announced just after the last issue of the Electrical News had gone to press, is now general manager of the Minneapolis General Electric Company, of Minneapolis, Minn., one of the several interests controlled by Messrs. H. M. Byllesby & Company, of Chicago. The inducements offered Mr. Pack in his new position were such as to quite justify his decision, but his removal to the United States is greatly to be regretted. Canada needs just such men as R. F. Pack—young, ambitious, broad-minded, enterprising and a worker. Steadily his ability was recognized until he became general manager of the company with which he had been associated since a youth; now he steps into a field which offers greater opportunities, and greater returns. Mr. Pack took a very active interest in the Canadian Electrical Association, of which he was elected president last June, and in this connection also his removal will be felt very keenly. About thirty of his electrical friends tendered him a dinner at the National Club on September 3rd, at which Mr. Frederic Nicholls presided. He was also given a dinner and presentation by the Department Managers of the Toronto Electric Light Company.

Boston Electric Show

From September 28th to October 26th, inclusive, what is claimed to be the greatest electrical exposition ever held in the world is being held in Boston under the auspices of the Edison Electric Illuminating Company. The exposition will occupy the entire Mechanics building, using 105,000 square feet of floor space. It is said that a world-wide search has been well rewarded with novelties, specialties and unique uses of electricity and that every exhibit will show moving appliances and machinery operated by electric power. Preparations have been made to accommodate an attendance of 1,000,000 people.

Canadian Electrical Association

Owing to his removal to the United States, Mr. R. F. Pack has tendered his resignation as President of the Canadian Electrical Association. Mr. W. L. Bird, of Fort William, who was first vice-president, has been elected as his successor.

Mr. C. A. Bowden, of Toronto, was appointed Secretary of the Association at a meeting of the Managing Committee held on September 4th.

Meter Tariffs—The Point of View of Both Central Station and Consumer

In considering various systems of charging a point which is not generally given the consideration which its importance demands is the consumers' point of view. Many varied systems, such as maximum demand, number of surface square feet, two separate meters, telephone, etc., have been employed and are more or less successful, but in all these systems considerable explanation is required to convince the consumer that the supply, be they company or municipality, are giving a fair deal. The flat rate is, in general, the most satisfactory from the consumers' point of view, being so easily understood, but the most unsatisfactory from the supply end.

A system which has recently been proposed in this country and is gaining considerable favor, is the "two-rate" system, the principle of this system being, that during peak load hours independent of what the current is used for, high or lighting rates are charged, while during non-peak hours, irrespective of the purpose for which the current is required, a low rate is given. This system has the great advantage from the consumers' point of view of being as easily understood as the flat rate system. It is a simple matter to explain on the basis of supply and demand, that it is possible to sell current during the day when the demand is less, at a lower figure than it is during the peak hours.

From the supply point of view it is necessary to study the various classes of consumer and for this purpose we will split them into three classes.

(1) The small consumer who can only afford a limited amount of light and uses the same on a strictly economic basis.

(2) The better type of consumer who will use light freely and would, if encouraged to do so, use toasters, cooking, and heating apparatus.

(3) Power consumer.

Now, in considering these three classes, No. 1 can be dismissed as being of little interest and a type where the flat rate is practically the only system of charging.

No. 2 is probably the type where the two-rate system applies to a greater degree than in either of the other two. This consumer is either treated to a maximum demand, two separate meters, or a flat rate. With the maximum demand, he cannot understand it and therefore is not encouraged to use more current. The only thing he is taught to do is to keep his load down as much as possible due to an unconscious dread of doing the wrong thing, and increasing his bill to a much greater figure than it should be.

With two separate meters, one for lighting only and one for other uses, neither the consumer nor the supply gets a benefit, as the consumer may easily have his cooking load on at 5.30 p.m. in the winter months when the ordinary lighting, and probably some power users, are all overlapping; while on the other hand, if he has a darkened room or basement in which he uses light all day, and in an extreme case not in the evenings, he is charged up at high rate. This then is obviously an unfair system. In addition to the foregoing there is the expense of dual wiring.

With the "two-rate" system, the following advantages are at once apparent. It is understood by the consumer. He is encouraged right away to use current during the non-peak hours as he knows it is cheap. He is also encouraged to keep down his consumption during peak hours, both of which conditions are ideal from the supply end.

Power Consumer.—This type of consumer, if placed on a "two-rate" system, will arrange as far as possible to keep off the peak hours, and provided he pays a high rate

during these hours, he can be given an even lower rate during the ordinary hours than is at present the case; hence it appeals to him, and is again the right system for the supply.

The foregoing remarks will have shown what a wide application this "two-rate" system possesses, and the following figures will show how it works out from a financial point of view and how the basic rates for the system should be obtained, which figures have been obtained from an electrical system actually operating in Canada.

Total number of kw.h. per annum 2,600,000, of which light uses 1,900,000 and power 700,000.

Fixed charges .79c per kw.h. on total.

Fuel charges 1.935c per kw.h. on total.

Cost as at present worked out the same for light and power: 2.725c per kw.h.

Lighting is charged at 8c, power at 4c. Apparent profit per lighting kw.h. 5.275; power 1.275, but since fixed charges are almost entirely due to the peak hours, and the lighting load comes mostly during the same hours, it is good finance to charge up against lighting, in the above, the whole of the fixed charges. The above figures would then show the following as the real cost per kw.h.

	Cents
Fixed charges per peak kw.h. on 1,900,000	= 1.08
Fuel charges per peak kw.h. on 1,900,000	= 1.935
Fixed charges per non-peak kw.h. on 700,000	= 1.935
Fuel charges per non-peak kw.h. on 700,000	= .00
Cost of peak load per kw.h.	= 3.015
Cost of non-peak load per kw.h.	= 1.935
Profit on peak load at 8c.	= 4.985
Profit on non-peak load at 4c.	= 2.065

From the above figures it will be seen that if the price per kw.h. on the "two-rate" system was fixed at 8c and 3½c for the house consumer the revenue would be only slightly reduced due to the lighting which is at present used on non-peak loads and a large increase in load (and revenue) would result due to other uses. To those who do not realize the importance of "other uses," the following figures of an actual installation will prove valuable. The connections have grown 1.846 kw.h. during the past year, of which 1.143 kw.h. are due to "other uses," these not including power.

As studied in reference to the power consumer the financial aspect shapes somewhat as follows:—

At present 6 full days at 9 hours each, 8 a.m. to 6 p.m. 54 hours per week, 2,800 hours per year. Presume the load to be 10 kw.h. per hour, 28,000 kw.h. per annum. At 4c this equals \$1,120. If this was charged on the "two-rate" basis, 8c peak load 3½c non-peak,—presuming the peak load was an average of one hour a day for six months, 156 hours, the figures are as follows:—

1560 kw.h. at 8c.	\$124.80
26440 kw.h. at 3½c.	925.40
	<hr/>
	\$1,050.20

a saving to the consumer of \$70 a year. If, however, the consumer arranges to keep off the peak load his bill would show a saving of \$140 per annum, and again, if he is on the peak load three hours a day for six months his bill would be \$70 higher than on the flat rate, and in each of these cases the returns are on a strict business basis from the supply point of view.

The expenses of the instrument for measuring on this principle is a point to be considered. When treating with class No. 2 this is approximately three times the cost of an ordinary meter, and to protect the supply against the consumer who might use the two-rate system for a few lights during the day-time, a minimum charge should be made on the low rate independently of the charge upon the high rate.

Western Canada Power Co. Development

**Two 12,500 h.p. Units Operating—Capacity to be Doubled at once—
100,000 h.p. Economically Available—Swiss Turbines, C.G.E. Generators**

In view of the recent announcement that the B. C. E. R. Co. have practically closed a contract for a block of 10,000 horse power with the Western Canada Power Co. which has its generating plant at a point on the Stave River, the following information reviewing the installation to date and the possibilities of the water powers owned at this point by the Western Canada Co., will be of interest. The delivery of power was commenced from this plant to the cities of Vancouver and New Westminster and at Mission and other points on the lower Fraser River Valley on January 1, 1912. It was the intention from the inception of the company to sell power in large blocks to municipalities or large private concerns rather than distribute to small consumers and in carrying out this idea they have been so successful that it will be immediately necessary to instal the full capacity of their first plant.

Power Development

The Power Development is located about 35 miles east of the city of Vancouver at the Stave River Falls, about six miles north from the junction of the Stave and Fraser Rivers, at Ruskin, British Columbia, and seven miles south of Stave Lake, which is utilized as a reservoir to equalize the flow of the Stave River. The mountains forming the watershed are granite; they rise above the timber line, and are covered with snow and small glaciers. The upper river is a large glacier-fed stream, and there are several smaller streams which empty into the lake, some of which flow directly from the glaciers in the high mountains on the west side of the lake. The lake is nine miles long and about one mile wide. The east and west shores are precipitous. At the head and foot of the lake there are large areas of low-lying land, which are flooded during high wa-

The total fall from the low water level of the lake to tide water is about 205 feet, and this has already been raised, by the construction of the existing dams at the upper power site at Stave Falls, to 210 feet; and this fall can be still further increased by raising these dams as additional storage is required. At an elevation of 235 feet these dams will enlarge the area of the lake and form a large



Power house, discharge side—W.C.P.Co.

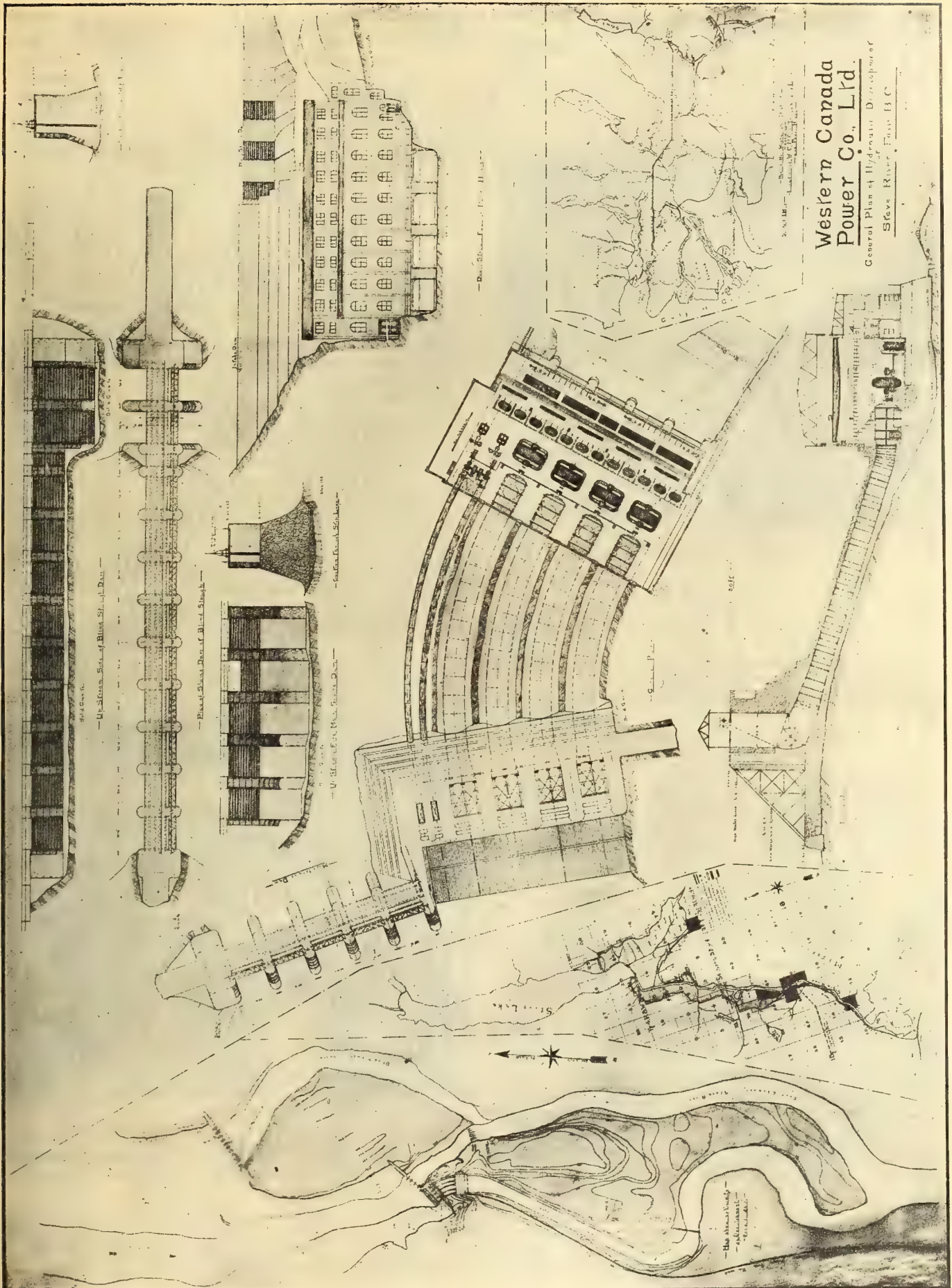


General view of power house site—W.C.P.Co.

reservoir extending from Stave Falls to the upper end of Stave Lake, a distance of sixteen miles, and having an area of approximately eighteen square miles; and this reservoir will be large enough to store the flood waters to a depth of thirty feet, so that the total mean flow of the river can be made available for the generation of power. The storage so obtained will be about 14,000,000,000 cubic feet of water. Careful calculations made from the daily gauge records show that, with this storage, a mean flow of 3,000 cubic feet per second can be utilized continuously for generating power. The intake dam is at present constructed to elevation 215, and is so planned that it can be raised to elevation 245, if and when additional storage is required. The flow of the stream is sufficient for the operation of the existing installation; but, with the intake dam raised to elevation 235 feet, a maximum head of 120 feet and an average head of 110 feet, can be obtained at the site of the present installation. With an average head of 110 feet, a flow of 3,000 cubic feet per second will produce 28,000 electrical horse power continuously for 24 hours daily, throughout the year, and, under usual operating conditions, will provide for a peak load of 50,000 horse power.

ter. From the foot of the lake to the Stave Falls the river is seven miles long. At the falls and the rapids, in the immediate vicinity of Stave Falls, the river drops eighty feet, and then continues on its course over a series of rapids for a distance of four miles, finally debouching through a narrow granite gorge into a tide-water basin, where it joins the Fraser River.

The company also owns a water right at a lower site, near the mouth of the river, where, by the construction of a dam not more than 120 feet high in a narrow, rocky gorge, the same water can be utilized over again, and an equal amount of power can be developed by the installation of four 13,500 horse power turbines. The company is, therefore, in a position to carry out hydro-electric developments on the Stave River, within thirty-five miles of the city of Vancouver, up to a capacity of 100,000 horse power, as rapidly as the market demands the power.



Key map of works, Western Canada Power Company, Stave Falls, B.C.

Rights and Franchises

The company holds water rights from the Provincial Government of British Columbia, and from the Dominion Government, which secure to the Company in perpetuity, the use of the waters of the Stave River at the site of the present hydro-electric installation at Stave Falls.

In addition to the franchises which authorize the construction and maintenance, in perpetuity, of its hydro-electric



Generator and exciter penstocks—W.C.P.Co.

works and main transmission lines, the company has obtained a number of very valuable municipal franchises, including: a 50 year franchise for power in the city of Vancouver; a 50 year franchise for power in New Westminster; a 20 year franchise for light and power in Burnaby, renewable by agreement; a perpetual franchise for light and power in Coquitlam; a 40 year franchise for light and power in Maple Ridge; and a 50 year franchise for light and power in Mission municipality.

The Present Development

The undertaking so far completed comprises the construction of the dams to a sufficient height to obtain a working head of 100 feet, and the construction of the power house for two units, each unit consisting of a turbine capable of generating 13,000 h.p. and a generator capable of generating 12,500 h.p. with the necessary complement of transformers and switchboards. Summed up, the work now completed includes:—

(1) The construction of the sluice dam to elevation 210 above tide water level.

(2) The construction of the blind slough dam to elevation 210.

(3) The excavation of the forebay, and the construction of the intake dam to elevation 215.

(4) The construction of the penstocks for two 13,000 h.p. turbines and two exciter turbines. The penstocks for the main turbines are 14 feet 6 inches in diameter and 150 feet long. The penstocks for the exciter turbines are four feet in diameter.

(5) The clearing of the tailrace to a width sufficient for the operation of two additional generating units, and the excavating of the power house site down to elevation 100 feet.

(6) The construction of the power house building of sufficient size for two units. This building is a concrete steel fire-proof structure, set on solid granite foundations, 100 feet square, which may be extended so as to contain two additional units.

(7) The installation of two 13,000 h.p. turbines and two 500 h.p. exciter turbines, all manufactured by the Escher Wyss Company of Zurich, Switzerland. The two large turbines weigh 165 tons each.

(8) The installation of two generators of a nominal rated capacity of 7,500 kw. each and two exciters rated at 250 kw. each. These generators, which were built by the Canadian General Electric Company, weigh 160 tons each, and are each capable of producing continuously 9,375 kw. or 12,500 h.p. each, at a power factor of 85 per cent. The normal voltage is 4,000, cycles 60; but they are guaranteed to run at a speed of 75 per cent. in excess of the normal.

(9) The installation of six 60,000 volt, 3,000 kv.a. step-up transformers weighing 24 tons each, manufactured by the Canadian General Electric Company. These transformers are all water-cooled, oil-insulated type, and are wound to step-up from 4,000 volts to 60,000 volts.

(10) The installation of the switchboards for two units and two transmission lines. These switchboards were manufactured by the Canadian Westinghouse Company. There are six 4,000 volt main switches and four 60,000 volt oil switches, completing the equipment for two generators, two banks of transformers, and two transmission lines. Aluminium cell lightning arresters are used to protect the station apparatus. All high tension wiring is enclosed in fireproof cells built up of concrete slabs.

(11) The construction of about 35 miles of double transmission line from the power house to the receiving station, which is located about half way between the cities of Vancouver and New Westminster. Steel towers, 60 feet high, situated about 600 feet apart, carry six No. 0 B. & S. gauge copper cables. The insulators are of the suspension type, designed for 60,000 volts. The Pitt River crossing consists of a span of steel cables, 1,300 feet in length, supported on two galvanized steel towers, each 165 feet in height, set on reinforced concrete piers, erected on foundations of heavy piles. The transmission line was described at length in the December 1911 issue of the Electrical News.



Interior receiving station at Ardley—W.C.P.Co.

(12) The construction of a receiving station between Vancouver and New Westminster, large enough for six step-down transformers, of a total capacity of 24,000 h.p. This receiving station is a reinforced concrete structure, about 50 feet wide and 80 feet long, and contains space for six 3,000 kw. transformers, and the necessary switches and apparatus for two 60,000 volt incoming lines, and about 10 outgoing 12,000 volt lines. There are four step-down transformers of the same size and type as the step-up trans-

formers, but wound for different voltages, viz., from 60,000 volt on the high tension side to 13,000 on the low. The general layout of switchboards is similar to that of the power house, excepting that the low tension voltage is 13,000, and there are 8 or 10 feeder switches.

(13) The erection of feeder and distributing lines as required by contracts with power consumers. At present more than 50 miles of 12,000 volt feeder lines, and 38 miles of 2,000 volt distributing lines have been constructed, extending to the cities of Vancouver and New Westminster, and the several districts of the Fraser River Valley from the city of Vancouver to Mission and Sumas; and a number of miles of underground mains have also been laid in the city of Vancouver.

The First Installation

The present installation of two generating units has a normal capacity of 25,000 horse power, and will carry continuously, if required, a 25 per cent. over-load. The bell-mouths for penstocks Nos. 3 and 4 have already been placed in the intake dam; and the tailrace excavation has been

completed to the entire width required for two additional units. The power house building has been so constructed that it can easily be extended to afford all the additional space necessary for the complete installation. The entire works have been designed and constructed by and under the superintendence of the general manager, Mr. R. F. Hayward, M.Am.Soc.C.E., M.A.I.E.E., in a manner which reflects the greatest credit upon Mr. Hayward's engineering skill and indefatigable energy. Much praise is also due Mr. Wm. McNeill, assistant general manager; Mr. A. R. MacKenzie, resident engineer at Stave Falls during construction work; Mr. F. D. Nims, electrical engineer, as well as to an efficient staff who ably assisted in carrying through this great work. The hydro-electric works of the company though economically constructed, are first-class in every particular, and are probably unexcelled by those of any other similar undertaking on this continent. They are capable of being extended to four times their present capacity at a minimum cost, and will serve districts which are rapidly increasing in population.

Plant Efficiency—Turbine to Meter

A Report on Tests Conducted on a Hydro-Electric Generating and Distributing System to Determine the Losses at Each Point

Actual figures on losses at the various points in a hydro-electric system are most difficult to obtain, though of inestimable value to the owner of any such plant, who may thereby form some estimate, by comparison, of the efficiency of his own equipment. A paper was recently read by Mr. J. D. Ross, of the Seattle Municipal Light & Power Plant, before the A.I.E.E., on extensive tests in connection with the operation of his company. Inasmuch as these results appear to have been most carefully taken and as the methods used in nearly every case are outlined in full, the paper is copiously reviewed below.

The Seattle plant is a hydroelectric system delivering water to two 1,500 kw. Pelton units and two 5,000 kw. turbine units under 600 ft. head through two pipes approximately $3\frac{1}{2}$ miles long, one of which is $67\frac{3}{4}$ and the other 49 in. inside diameter. The current is transmitted at 60,000 volts through two lines to Seattle, a distance of 38.7 miles, and is there distributed at 15,000 and 2,400 volts for use by approximately 20,000 customers and for the city street lighting.

Pipe Lines and Penstocks

The $67\frac{3}{4}$ -inch pipe consists of 15,865 ft. of wood stave pipe dividing at a point 951 ft. from the power house into two 48-in. riveted steel penstocks. The 49-in. wood pipe joins on to a 48-in. riveted steel penstock at a point 1,008 ft. from the power house.

Careful tests were made on the $67\frac{3}{4}$ -in. wood stave pipe, using gauges calibrated before and after. The pipe contains five steel elbows, where the curvature is greater than 20 deg. These elbows are made to a 15-ft. radius and have angles respectively 92, 55, 60, 65, and 45 degrees. The loss in head of each elbow was measured by a differential pressure gauge. The results of the test are given in detail in the following table:

The loss in entry as given in the above table seems large and rises with the velocity more rapidly than it should. This is explained as due to the resistance of the screens, which are of wood bars. The entry of the pipe is bell-mouthed. The total length of the wood pipe is 15,865 ft. The line was designed for a slope of four feet per thousand feet to give a velocity of ten feet per second.

LOSS OF HEAD IN FEET IN VARIOUS PARTS OF $67\frac{3}{4}$ -IN. (172 CM.) WOOD STAVE PIPE

Vel- ocity in ft. per second	Loss in entry and screens	El- bow No. 1 92°	El- bow No. 2 55°	El- bow No. 3 60°	El- bow No. 4 65°	El- bow No. 5 45°	Total loss in pipe	Friction loss after deduct- ing en- try and elbows	Loss in $67\frac{3}{4}$ " stave pipe per 1,000 feet	Value of C. in Kut- ters for- mula	Value of N. in Kut- ters for- mula
2½	.06	.03	.03	.03	.03	.01	4.1	3.91	.246	134.06	.01190
5	.25	.09	.08	.08	.08	.05	15.4	14.77	.931	137.96	.01175
7½	.54	.25	.18	.19	.20	.14	33.9	32.40	2.0425	139.71	.01165
10	1.14	.46	.34	.36	.37	.27	61.9	58.96	3.775	137.01	.011865

The loss in the penstocks was computed from records taken by Bristol recording gauges at the generating station, which were frequently calibrated. The results so obtained were checked by computing the loss from the efficiency shown under test, and agreed very closely. The maximum output of the two penstocks was 12,400 kw., with a loss of 6 per cent., and the average output for the year was 6,009 kw., with an average loss of 2.3 per cent. This loss was increased by the fact that the plant was supplied for thirty-three days in November and December by the larger pipe alone.

Generating Station

There are four units in the power house, two of which consist of 8,000 h.p. Francis turbines direct-connected to 60-cycle, 2,300-volt, three-phase generators rated at 4,000 kw. at 35 deg. C. rise, with four hour overload capacity of 5,000 kw. at 40 deg. C. rise. These units operate at 600 r.p.m. The other two units are driven by 2,400 h.p. Pelton impulse wheels direct-connected to 60-cycle, 2,300-volt, three-phase generators rated at 1,200 kw. at 35 deg. C. rise, with four hour overload capacity of 1,500 kw. at 40 deg. C. rise. These units operate at 400 r.p.m. The wheels are each equipped with two runners, each of which is supplied from a needle and a deflecting nozzle. The combined capacity of the present installation is therefore 13,000 kw. on a 40 deg. C. rating. The two machines last mentioned, however, exceed their rating and have been operated continuously without excessive heating at 1,750 kw., making the combined capacity 13,500 kw. Three water wheel exciter

units are installed, two of which have a capacity of 75 kw. each, and the third 150 kw.

As the efficiency of each unit varies with the load, and it is obviously impossible to have all generators that are in use at any time carry their full load, the all-day efficiency of the generating station will depend on the number of units in use and the load which each carries, as well as on the power factor of the load and, in the case of this plant, where two types of wheels are used, it will also depend on the proportion of the load that the operator gives to each type of machine.

While the combined maximum efficiency of generator and wheel was found in the case of the 5,000 kw. units to be 76.7 per cent., and in the case of the 1,500-kw. units to be 69.9 per cent., the all-day efficiency of the plant for 1911 was found to be 56.7 per cent. This does not include current for excitation and station lighting. By including this as a loss, the all-day efficiency of the plant drops to 55.7 per cent.

The reason for the difference in the same type of unit is found in the fact that the operators favor No. 1 and No. 4 machines, from habit rather than intention. The impulse wheels, being small, are operated under full load for a great part of the day and their all-day efficiency is greater than that of the turbines, notwithstanding the higher efficiency of the turbine sets at full load. It will be readily seen from these facts that the efficiency of a plant depends very largely on the way it is handled by the operator, and during low water periods it is possible to prepare a schedule showing which machines should be used for each load which the plant carries. This schedule will be modified by the conditions of the plant, changes in load, and regulation.

Losses in the water wheels and generators were computed from the half-hour wattmeter readings on the generators as recorded in the station report. The input for each output throughout the year was computed from efficiencies shown in tests made in 1909 and checked at the end of 1911. The results show all-day efficiencies for the year as follows:

EFFICIENCY

	Wheel	Generator	Combined
Impulse Unit No. 1.....	70.8	93.0	65.8
Impulse Unit No. 2.....	66.3	92.2	61.1
Turbine Unit No. 3.....	57.1	93.0	53.1
Turbine Unit No. 4.....	63.6	94.1	59.8
Four units combined.....	60.7	93.5	56.7

The higher efficiency of the impulse units is due to the fact that they were nearly always loaded above 900 kw. and the regulating was done with the relief valves and governors on the turbines, so that there was little loss from the deflecting nozzles.

The power used in excitation was computed from the half-hour readings on the exciter outputs, and amounted to 399,120 kw.h. or 1.3 per cent. of the output of the generators. The water input to the exciter units, computed similarly to that of the large units, was 665,200 kw.h. Station lighting, including light for the employees' cottages, amounted to 175,000 kw.h. for the year.

Step-Up Transformers

The station is equipped with nine transformers. Each bank of three has a normal capacity of 4,500 kw. at 35 deg. C. temperature rise. These transformers step the voltage from 2,300 to 60,000 volts three-phase star connected. The neutral of the star connection is grounded. These transformers were all in circuit continuously to keep them in good condition, and their core losses were practically constant, amounting to 926,000 kw.h., or an average of 11.7

kw. per transformer. The copper loss was computed from the readings on the reports, and amounted to 200,000 kw.h. or an average of 2.54 kw. per transformer.

	Kw.h.	Average kw.
Core loss	926,000	106
Copper loss	200,000	2.54
Total loss	1,126,000	129
All-day efficiency	96.1 per cent.	

High-Tension Lines

There are two high-tension lines 38.7 miles in length strung on two different makes of insulators of practically the same size and type. One of these lines is of No. 2 solid medium hand-drawn copper, the wires being placed in a six-foot triangle. The other is built of No. 0000 seven-strand hard-drawn copper, the wires being placed in a seven-foot triangle.

The line loss was computed from the constants of the lines, taking the load data shown by the report sheets. The line resistances were measured by direct current, using the fall of potential method, and agreed very closely with the computed value. The inductance and capacity were calculated from the values given in the Standard Handbook, third edition. To simplify calculation for the all-day efficiency, a Perrine-Baum regulation diagram was drawn for both lines in parallel. To this were added circles, taking as a center the end of the substation voltage, and as a radius the square of the voltage drop in the line, multiplied by the conductance of the line. The radii of these circles represent power loss. The power lost during 1911 on the two lines, figured from this diagram, using the half-hour readings at the substation for load data, amounted to 378,000 kw.h. or an average of 43 kw. for the year.

	Kw.h.	Average kw.
Line loss	378,000	43
All-day efficiency	98.6 per cent.	

Step-Down Transformers

The step-down transformers are placed on the first floor of the substation. There are at present eight of these, each of 1,500 kw. capacity at 35 deg. C. temperature rise. All are made with a ratio of 54,000 volts, three-phase to 15,000 and 2,500 Scott connected two-phase, making four banks of transformers. The low-tension coils are connected in series for 15,000 and in multiple for 1,500 volts, two banks being used on each voltage.

The step-down transformer loss, computed in the same way as that of the step-up transformers, was as follows:

	Kw.h.	Average kw.
Core loss	692,000	79
Copper loss	217,500	25
Total loss	909,500	104
All-day efficiency	96.6 per cent.	

The sum of the losses in line and transformers was checked against the difference in the watt-hour meter readings on the low-tension side of the transformers at each end of the line, and was about five per cent. lower. This may not have been due to error but may be largely due to corona loss or other line leakage. No measurements have as yet been made to determine this point.

Main Substation

The main substation contains the step-down transformers, a distributing switchboard of the remote control type, and the necessary switching and control apparatus for the distributing feeders. The switchboard carries a complete set of curve-tracing meters for the high-tension lines, indicating ammeters and wattmeters and watt-hour meters for the transformers, and indicating ammeters, recording voltmeters and watt-hour meters for the feeders. Loss in meters and their instrument transformers was computed from tests

made on each type of meter and transformer. Current used for station light, heat and display lighting was metered.

	Kw.h.	Average kw.
Loss in meters	29,000	3
Power for station light	317,400	37
Total loss	346,400	40
All-day efficiency	98.7 per cent.	

Motor-Generator Set

A motor-generator set consisting of a 750-h.p., two-phase synchronous motor direct-connected to two 250-kw. 250-volt d.c. compound-wound generators is used on a three-wire 500 and 250-volt system for operating elevators and other motors. The maximum load on this machine at the present time on the direct-current side is 300 kw. and the average load for 1911 was 30.2 kw. The surplus kilovolt-ampere capacity of the motor is utilized in regulating the voltage of the main system by varying the power factor by means of a Tirrill regulator controlling the field of the motor. There are at present 71 services connected on this system with a connected load of 772½ h.p. The main feeder is 750,000 c.m. cable with a 400,000 c.m. neutral, and the branches usually No. 4/0 with No. 2/0 neutral. In all, 27 miles of wire are used on this system.

The total loss in the direct-current feeders and the motor-generator was obtained from the difference in the motor watt-hour meters and the customers' meters. From recording volt-meter charts taken at various distributing points and at the substation and from computations, using the load data and line resistance, the line loss is placed at 5 per cent. The details of losses and efficiencies follow:

	Efficiency, 1911	Loss, kw-hr.	Average loss, kw.
Motor-generator	38.	417,000	48
Direct-current lines	95.0	12,800	1
Customers' meters	98.8	3,000	..
Total direct-current system	35.7	432,800	49

15,000-Volt System

Current is distributed at 15,000 volts from the main substations to two smaller substations and to about twelve mills and factories which use large amounts of power. This system is two-phase, with the center point of each phase grounded. For mechanical reasons, No. 2 is the smallest wire used on the 15,000-volt lines. There are about 105 miles No. 2, nine miles of No. 1, and two and one-half miles of No. 0 wire. There are 30 transformers connected, ranging in size from 750 kw. to 50 kw., with a combined capacity of 6,250 kw.

Loss in the 15,000-volt system was found by taking the difference in the meter readings at substation and at the various receivers, and checked closely by calculation from the line constants and load data. The transformer losses on this system were computed from the load data on the station reports and the tests taken on each size and type of transformer under actual operating conditions.

Copper loss is small compared to core loss because the transformers were lightly loaded; an installation of 6,250 kw. carried an average load of 1,323 kw. The detail losses were:

	Efficiency, 1911	Loss, kw-hr.	Average loss, kw.
15,000-volt lines	99.2	93,500	11
15,000-volt transformers	93.2	775,100	88
Core loss		694,000	79
Copper loss		81,100	9
Total for system	92.5	868,600	99

2,400-Volt Distributing System

Power is distributed from the substations by means of seventeen 2,400-volt primary feeders. The more heavily loaded circuits were designed for 200 amperes and the lighter ones for 150 amperes. Number 4/0 wire was used at first, but the economic size for a 200-ampere feeder has been computed at 350,000 c.m., which size is now used on the heavier feeders.

An area of 28 square miles is served by this system. A distributing point is established at the approximate center of distribution for each feeder, and the automatic regulators in this station are set to give the desired voltage at this point. Connected to the 2,400-volt feeders are 1,082 distributing transformers, ranging in size from 2½ kw. to 50 kw., and with an aggregate full-load capacity of 9,268½ kw. They are connected to give a 240-120-volt three-wire low-tension winding, with the neutral grounded. To aid regulation, a number of transformers of the same size and type are usually connected together on the low tension side where conditions will permit. The secondary wire is generally No. 4 for the outside wires and No. 6 for the neutral, with No. 8 for the services. The maximum voltage drop from transformer to customer is kept within 2 volts whenever possible, since there is no way of regulating for voltage between these points. The pressure at the service is kept as near 120 volts as possible. Although standard 2,200-110-volt transformers are used, the pressure has been raised to 2,400 volts, and it is planned to raise it still further to 2,500 volts. This gives about 25 per cent. higher core loss, but lowers the copper loss in both transformers and feeders about 29 per cent., and in addition gives nearly 14 per cent. better regulation. The 2,400-volt system used 545.4 miles of high-tension wire, ranging in size from No. 6 to 350,000 c.m., and 1,137.7 miles of low-tension wire, varying from No. 6 to No. 4/0.

Losses in the feeder regulators were computed from tests made on each type used, in conjunction with load data from the station reports. Losses in distributing transformers were computed in the same way, using also recording ammeter charts taken at distributing points. Losses in the high-tension line were computed from the load data and line resistances of each feeder, and checked by recording volt-meter charts taken at the station and at each distributing point. Loss in low-tension line was estimated from line resistances and load data, and checked by recording volt-meter at the customers' services. Loss in the customers' meters was computed from tests on each type of meter in use.

A check on the various distributing losses is furnished by the difference in the power metered to the customer and that delivered to the distributing system. This amount proved to be slightly greater than the sum of the losses as computed, and the difference was added to the loss in low-tension system, since that loss was most difficult to determine with accuracy. There is also probably a small amount of stolen current included in the low-tension loss. The details of losses on the 2,400-volt commercial system follow:

	Efficiency,	Loss, kw-hr	Average loss, kw.
Feeder regulators	98.6	178,500	20
Primary feeders	96.0	521,600	60
Distributing transformers	88.8	1,391,000	159
Core loss		960,000	110
Copper loss		431,000	49
Secondaries	92.9	782,600	89
Customers' meters	97.6	250,000	29
Total for system	76.2	3,123,700	357

	Per cent all-day efficiency	Total 1911 input, kw-hr.	Average 1911 input, kw.	Total 1911 loss, kw-hr.	Average 1911 loss, kw.	Per cent loss	Per cent of penstock input	Per cent of total loss
GENERATING SYSTEM.....	54.4	52,619,000	6009	23,990,300	2739	45.6	45.6	75.3
Penstocks.....	97.7	52,639,000	6009	1,214,900	139	2.3	2.3	3.8
Generating station.....	55.7	51,424,100	5870	22,775,400	2600	44.3	43.2	71.5
Water wheels.....	60.7	50,758,900	5795	19,944,400	2277	39.3	37.9	62.6
Generators.....	93.5	30,814,500	3518	1,990,800	227	6.5	3.8	6.2
Exciters.....		665,200	76	665,200	76		1.3	2.1
Station lights and control.....		175,000	20	175,000	20		0.3	0.5
TRANSMISSION SYSTEM.....	91.6	28,648,700	3270	2,413,500	276	8.4	4.6	7.6
Step up transformers.....	96.1	28,648,700	3270	1,126,000	129	3.9	2.1	3.5
Transmission lines.....	98.6	27,522,700	3141	378,000	43	1.4	0.7	1.2
Step-down transformers.....	96.6	27,144,700	3098	909,500	104	3.4	1.7	2.9
DISTRIBUTING SYSTEM.....	79.2	26,235,200	2994	5,448,700	622	20.8	10.3	17.1
City substation.....	98.7	26,235,200	2994	346,400	40	1.3	0.7	1.1
S. Lights and control.....		317,400	37	317,400	37	1.2	0.6	1.0
Switchboard meters.....				29,000	3		0.1	0.1
15,000-volt system.....	92.5	11,587,000	1323	868,600	99	7.5	1.6	2.7
15,000-volt lines.....	99.2	11,587,000	1323	93,500	11	0.8	0.2	0.3
15,000-volt transformers.....	93.2	11,493,500	1312	775,100	88	6.8	1.5	2.4
Series street lights.....	86.3	2,672,800	305	367,200	42	13.7	0.7	1.2
Transformers.....	95.0	2,672,800	305	133,700	15	5.0	0.3	0.4
Series circuits.....	90.8	2,539,100	290	233,500	27	9.2	0.4	0.7
Cluster street lights.....	79.1	1,486,000	170	310,000	35	20.9	0.6	1.0
Cluster transformers.....	87.8	1,486,000	170	181,000	21	12.2	0.3	0.6
Underground cables.....	90.1	1,305,000	149	129,000	15	9.9	0.2	0.4
2400-volt commercial system.....	76.2	13,178,400	1612	3,123,700	357	23.8	5.9	9.8
Feeder regulators.....	98.6	13,178,400	1612	178,500	20	1.4	0.3	0.6
Primary feeders.....	96.0	12,999,900	1592	521,600	60	4.0	1.0	1.6
Transformers.....	88.8	12,478,300	1532	1,391,000	159	11.2	2.6	4.4
Secondaries.....	92.9	11,087,300	1373	782,600	89	7.1	1.5	2.5
Customers' meters.....	97.6	10,304,700	1284	250,000	29	2.4	0.5	0.8
Direct-current system.....	35.7	673,200	77	432,800	49	64.2	0.8	1.4
Motor-generator.....	38.0	673,200	77	417,000	48	62.0	0.8	1.3
D-C. circuits.....	95.0	256,200	29	12,800	1	5.0		
Customers' meters.....	98.8	243,400	28	3,000		1.2		

SUMMARY: Total power loss..... 31,852,500 kw-hr. Average 3,636 kw.

Total power delivered to customers..... 17,304,900 " " 1,975 "

Total power delivered to street lamps..... 3,481,600 " " 398 "

Total delivered power..... 20,786,500 " " 2,373 "

Over-all efficiency, 39.5 per cent.

[1 kw-hr. at the customers' premises requires 1,364 gallons (5,163 liters) of water from Cedar Lake at average head of 590 feet (179.8m.).]

Summarized Table showing Losses and Efficiencies of each part of the system

Cluster Light System

The cluster light system comprises 1,631 poles, lighting 25 miles of street and carrying 6,851 lamps of a total of 335,700 watts. This system is supplied from 720 kw. in transformers using 23 miles of primary wire carrying 2,400 volts and 98.4 miles of secondary wire in a 240 and 120-volt three-wire system. The voltage is changed from 120 volts

to 8 volts in the base of the pole and 8-volt multiple lamps are used. Losses on this system were computed in a similar manner to those on the other distributing systems. They lack the check of integrating meters at the lamp, but were easier to compute on account of the constancy of the load. The transformer losses contain those from the pole-base transformers, which are 250-watt, 8-volt transformers.

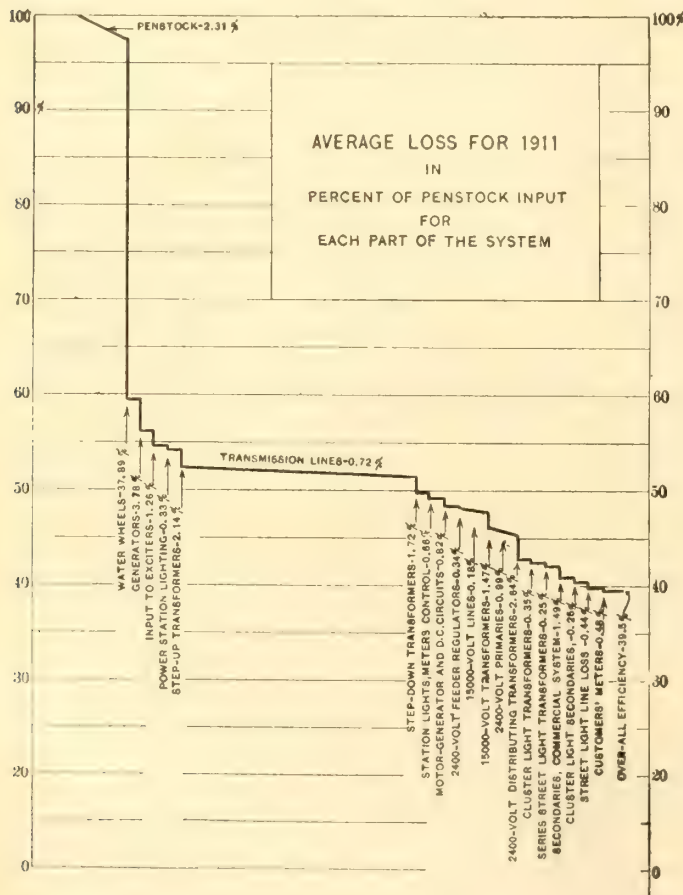


Diagram showing each loss, in percent of penstock input

	Efficiency, 1911	Loss, kw-hr.	Average loss, kw.
Cluster light primaries.....	97.0	42,500	5
Cluster light secondaries.....	93.0	86,500	10
Cluster light transformers.....	87.8	181,000	21
Core loss.....		117,500	13
Copper loss.....		63,500	7
Total for system.....	79.1	310,000	35

Series Street Lighting System

The series street light system comprises 683 miles of No. 6 wire divided into 29 circuits, lighting 601 miles of street. The circuits are connected two in series to 100-light air-cooled constant-current transformers. The voltage on the circuits varies with the number and kind of lamps from 2,500 volts to 5,000 volts. Altogether there are 692 6.6-ampere arc lamps, 5,315, 40-candle-power tungsten lamps, and 199, 300-candle-power tungsten lamps. Losses were computed in a similar manner to those on the cluster light system, and were as follows:

	Efficiency, 1911	Loss, kw-hr.	Average loss, kw.
Series lines.....	90.8	233,500	27
Constant current transformers.....	95.0	133,700	15
Core loss.....		63,900	7
Copper loss.....		69,800	8
Total for system.....	86.3	367,200	42

The table shows the losses and efficiencies for each part of the system, and the accompanying diagram shows each loss expressed in per cent. of penstock input.

Vancouver and the Pacific Coast

Prince Rupert Hydro-Electric Co.

While in England, Mr. R. F. Hayward, the general manager of the Prince Rupert Hydro-electric Company, Ltd., ordered from Dick, Kerr & Co., Preston, two 750 horse power Diesel engines, which are to be shipped at the earliest possible moment. These oil engines are among the first of the kind to be used in Canada in connection with a hydro-electric power plant. Oil is very cheap on the Pacific Coast, and it is expected that the engines will contribute to a low working cost of the plant. These engines will be installed on Porpoise Harbor, near Prince Rupert, and it is hoped they will be running next spring. The staff of the company have collected a very large quantity of data, the preliminary work being of a more than usually complete character. Following the installation of the Diesel engines, it is proposed to construct hydro-electric works for the development of 5000 horse power, and to extend this as the demand grows. The water power will be obtained from the Khtada Falls and the Falls River, about 42 miles from Prince Rupert, the power house being situated on the Falls River. When the hydro-electric power plant is installed, the Diesel engines will be used as a stand-by.

New Telephone Plant in Victoria

The new plant of the B. C. Telephone Company at Victoria is housed in a handsome four storey structure built by the company, and but recently completed, at the corner of Johnson and Blanchard streets. The cost of the building was \$60,000. Expenditure for equipment was approximately \$200,000 and the plant is one of the most modern in the West. The new common battery switchboard had a capacity of 10,000 lines when installed, later being fitted to care for the traffic of 15,000 subscribers. The rack room is located on the second floor of the building, the cables entering from below for distribution. The battery room and dynamos are on this floor, also the office of wire-chief MacDonald. The top floor is devoted to the operating room, and carries the main switchboard, long distance, board complaint and information desks, and desks for chief operators. The stores department is quartered in the basement of the building. The cable pit at the Victoria office, showing splicing, is seen in the accompanying photograph.

Ambursen Dam at Jordan River

The announcement is made from Seattle that the Puget Sound Bridge and Dredging Company of that city, has been awarded the contract by the B. C. E. R. Co. for the construction of a large dam on the Jordan River, Vancouver Island, the estimated expenditure being \$500,000. The dam will be 800 feet long and 115 feet high. It will be of the

Ambursen type of reinforced concrete construction. The construction plan was chosen by G. R. G. Conway, of the B. C. E. R. Co., after thorough consideration of the respective merits of solid concrete and other forms of dam. The undertaking represents part of the development plans of the B. C. Electric on the Jordan River hydro-electric project. The generating station was opened last year with a unit of 6,000 horse power in operation and another unit of 6,000 horse power is now being installed at the plant. The plans of the company for the station contemplate a total output of 36,000 horse power.

Point Grey Finally Gives Franchise

On September 7th the electors of Point Grey municipality granted a franchise to the B. C. E. R. Co. for the operation of a street car system through that district. The term of the franchise is for 37 years and 6 months, with a separate clause covering a through line across the district for a term of 99 years. The granting of this franchise closes a long drawn out controversy concerning transportation facilities in Point Grey. A few years ago a franchise throughout the district was granted the company by the council, but this was quashed by the British Columbia courts and is now the subject of an appeal by the company to the



Cable pit, showing splicing—B. C. Telephone Co., Victoria

Privy Council. Last January a tram franchise by-law was submitted to the electors and was defeated and a council elected which was in opposition to the granting of the franchise. An attempt was made to operate a motor bus line as a municipal undertaking, but this was unsuccessful and the project abandoned after a short trial, resulting in a considerable loss to the municipality. The ratepayers then requested the council to again submit the tram franchise by-law almost identical in terms with that which was defeated last January. This was done as noted, the measure being passed at the polls. Immediately upon the announce-

nment of the poll the company resumed operations upon the various lines in Point Grey where service had been given previous to the quashing of the prior franchise. The tram agreement calls for numerous extensions of the lines throughout the district and plans for the construction of these are now being made. The Point Grey system will be operated in connection with the Vancouver lines. Throughout Point Grey the passing of the by-law is hailed with great satisfaction as the district is a suburb of Vancouver and affords excellent opportunity for suburban homes. It is now believed that the development of the district, which has been held back during the present year because of lack of transportation facilities, will be extremely rapid.

Victoria Items

The B. C. Electric Company are making good progress in the building of their transmission line to the Bamberton Cement Works, this plant will take approximately 3,000 h.p. and is expected to be operating this Fall.

Langford, a settlement about ten miles from Victoria, will be supplied with electric light and power; arrangements having been entered into with the B. C. E. R. Co. to build a line in.

Oak Bay, a municipality adjoining the city of Victoria, is negotiating with the B. C. E. R. Co. for a street lighting system. It is the intention to have the installation in before Fall. The equipment will be a series tungsten system.

Victoria presented an unusually pretty scene on the occasion of the Royal visit of the Duke of Connaught and party. Special electrical displays were in evidence, comprising the outlining of the Parliament Buildings, Empress Hotel, Post Office and various other prominent buildings.

A new sign by-law has just been passed by the city council of Victoria. All signs in future must be of metal construction and illuminated by electric light and provision must be made for swinging signs in.

The B. C. Electric Railway Company have extended their lighting lines to Cadboro Bay, some five miles from Victoria.

"Uplands," a high class residential district close to Victoria, is to have all wires underground, this work being done by the French syndicate, which is putting the property on the market.

Extension to Sub-Station

The B. C. E. R. Co. is at present constructing an extension to its sub-station on Main street in Vancouver, this being the principal sub-station of the company. The plans call for a building on the north side of the present sub-station, 50 by 120 feet in size. At present the building will be only two storeys in height, but the foundations have been made sufficiently strong for two or three additional storeys as the need develops. The cost of the building will be about \$40,000. When completed a full set of sub-station equipments will be installed, to be operated in connection with the equipments of the old building. The transformers and controllers will be located on the ground floor, and the switching apparatus and high tension equipments on the upper floor.

B. C. E. R. in New Offices

On September 3rd the head office of the B. C. E. R. Co. in Vancouver, B.C., was removed from temporary quarters in the Holden Block to the company's new office building and terminal station at Hastings and Carrall streets. The new building is five storeys in height, with an area of 15,000 feet of floor space on each storey. The block is admitted by all to be one of the finest office buildings in the city. The

fittings of the building throughout are of the best type and the building now affords a proper and fitting home for the accommodation of the staff of the largest corporation in British Columbia which operates exclusively within the borders of the province. The total cost of the building is about \$120,000.

Ashcroft Water and Electric Company

The Ashcroft (B.C.) Water & Electric Improvement Company intends to apply for a license to store or pen back 124,800 acre feet of water from Bonaparte Creek which flows into the Thompson River near Ashcroft, and 4,800 acre feet from Loon Creek, about 25 miles distant. The water will be stored in three reservoirs to be built respectively at Bonaparte Lake, Young Lake and Loon Lake. The company is also applying for a license to take and use 300 cubic feet of water per second from Bonaparte Creek.

Canadian Collieries

Canadian Collieries, Union Bay, B.C., have just placed an order with the Siemens Bros. Dynamo Works for two electric hoisting engines, together with electrical control apparatus. The first has a peak load of 1,300 h.p. and the second has a peak load of 700 h.p. The same company are also supplying two motor generator sets, one for each of the above hoisting engines.

Alberni Hydro-Electric Company

The city of Port Alberni, on Vancouver Island, is at present negotiating with the newly-formed Alberni Hydro-Electric Company for an electric light and power service. The company has made a thorough survey of the power possibilities of Beaver Creek at the base of Beauford Mountain where it is proposed to generate 8,000 horse power for the city's needs.

Wanata Development Company

The Wanata Development Company, Limited, of Nelson, B.C., is applying for a license to take and use 100 cubic feet of water per second from Salmon River. The water is to be diverted about a mile and a half from the mouth of the river and to be used for the development of power in the Ymir electoral district.

Telephone Operations at the Coast

The engineers of the B. C. Telephone Company have selected landings on the Mainland and on Vancouver Island for the second submarine cable which the company is to lay under the Gulf of Georgia. This cable will stretch from Point Grey near Vancouver to a point in the vicinity of Nanaimo. The landing at Point Grey will be effected on the north side of the promontory a little to the west of the point where the C. P. R. telegraph cable is landed. On Vancouver Island the landing will be in a small bay on the east side of Newcastle Island, and the narrow channel separating it from Vancouver Island, will be flown with high fixtures. The route of the highway will thence be followed to the company's office in Nanaimo.

The permission of the Provincial Government is being sought by the B. C. Telephone Company for the laying of a telephone cable over the government bridge which crosses the Fraser River at the city of New Westminster. The cable it is proposed to lay across the bridge will have a length of approximately 3,000 feet. It will carry some fifty pairs of wires, some of which will be large gauge for the

through lines running to the south of the river. The proposed new cable will serve all the Bellingham, Seattle, and Victoria lines, also the Ladner, Abbotsford, Milner and other lines carried by the company south of the Fraser in the present submarine cable.

According to plans, the new \$160,000 Highland Exchange in Vancouver, the fourth exchange in that city, was "cut over" on September 1. Some 900 lines are at present served by the Highland Exchange, which is located on Turner St., in the Grandview district. It is expected that more than double this number of lines will be tributary to this office by the end of the present year. The ultimate capacity of the board will be 10,000 lines.

Within a few months the B. C. Telephone Company will start construction of a line from Vancouver right through the centre of Point Grey municipality. This line will con-

nect with the landing place of the new cable to be laid next spring between Point Grey and Nanaimo on Vancouver Island.

A 400-line extension is on order for the switchboard of the North Vancouver office of the company. The original installation is now practically filled and there is every evidence of substantial growth in the telephone requirements of that city in the immediate future.

The B. C. Telephone Company will shortly erect a five-storey fireproof structure on the corner of Yukon and Front streets, Vancouver. The new building will cost about \$100,000, and is planned to take care of the storage and plant departments. Mr. C. H. Bollschweiler, general superintendent of plant and all of the officers connected with the construction branch of the company, will be located in this building.

Progress in the Prairie Provinces

Edmonton Making Extensive Additions

The city of Edmonton was the first city in the west to control its own electric lighting plant, having taken over the plant from a private company in 1901. Edmonton now controls all of its public utilities, a gas plant which will be erected shortly being the latest addition. The plant, at the date it was taken over, was a very modest affair, consisting of a 75 kw., 100 volt, 133 cycle, belt-driven, single-phase generator, and when compared with the extensive equipment of the present time, outlined below, indicates the rapid growth of the city's electrical requirements.

The present equipment consists of:—

Three 300 h.p. Babcock & Wilcox boilers.

Eight 400 h.p. Babcock & Wilcox boilers.

Two 500 h.p. Goldie & McCulloch boilers.

One 75 kw., 2200 volt, 3-phase, 60 cycle generator, direct connected to an Ideal engine.

One 200 kw., 2200 volt, 3-phase, 60-cycle generator, direct connected to a Goldie & McCulloch engine.

One 225 kw., 2200 volt, 3-phase, 60 cycle generator, direct connected to a Robb Armstrong engine.

One 450 kw., 2200 volt, 3-phase, 60 cycle generator, direct connected to a Robb Armstrong engine.

One 1000 kw., 2200 volt, 3-phase, 60 cycle generator, direct-connected to a Goldie & McCulloch engine.

One 600 kw., 2200 volt, 3-phase, 60 cycle generator, direct connected to a Goldie and McCulloch engine.

One 700 kw., 2200 volt, 3-phase, 60 cycle generator, direct connected to an Allis Chalmers gas engine.

One 2000 kw. Westinghouse steam turbo-generator set.

One 400 kw., 550 volt, d.c. generator, direct-connected to a Belliss & Morcom engine.

One 400, 550 volt, d.c. generator, direct-connected to a Robb-Armstrong engine.

One 275 kw., 2200 volt, a.c.—550 volt, d.c. induction motor-generator set.

One 300 kw., 2200 volt, a.c.—550 volt, d.c. induction motor-generator set.

The following additions to the plant will be made this year:—

Four 500 h.p. Babcock & Wilcox boilers with chain grate stokers.

One 2000 kw. Willans & Robinson, high pressure steam turbo-generator set.

One 750 kw., 500 volt, d.c. generator, direct-connected to a Belliss & Morcom engine.

One 500 kw., 2200 volt, a.c.—550 volt, d.c. synchronous motor-generator set.

The greater part of the above equipment is located in the power house on the north bank of the Saskatchewan River. The south side power plant which is located on the south bank of the river and which, previous to the amalgamation of the municipalities of Edmonton and Strathcona, furnished power and light to the latter city, is now shut down and held in reserve. This reserve plant has a capacity of 875 kw. It will, most likely, be dismantled, and set up in the main power house on the north bank at some future date.

The capacity of the plant, it will be seen from the above, is 5250 kw., a.c., and 1375 kw., d.c., and these totals are being added to this year by the addition of a 2000 kw. high pressure, steam turbo-generator set, made by Willans & Robinson, of Rugby, England, and one 750 kw., 550 volt, d.c. generator, direct connected to a Belliss & Morcom engine, and one 500 kw., 2200 volt, a.c.—550 volt, d.c. synchronous motor-generator set.

The energy for power and lighting is distributed at 2200 volt, 3-phase primary. This is reduced to 110/220 volt single-phase secondary for lighting, which is distributed on all three phases and to 220 volt and 500 volt three-phase for power. All motors above 3 h.p. are required to be three-phase.

The generation and distribution are under separate departments, each controlled by a superintendent, the superintendent of the power plant being responsible for the generating end only, while the superintendent of the electric light and power department is responsible for the distribution from the wire tower, located outside of the power house and sale of the energy to the consumer. The power for the street railway department is distributed by that department.

All distribution is carried over head at the present time, poles being located in lanes wherever possible, the number of poles and overhead conductors on streets being kept at a minimum.

The rate for lighting is 8 cents per kilowatt hour, with a minimum rate of 50 cents per month. Bills are subject to a discount of five per cent. if paid within ten days. No charges are made for meter rent, same having been recently abolished. The rates for power are as follows:—

Up to 150 kw. hours, 8 cents per kw.hr.

150 to 300 kw. hours, 4 cents per kw. hr. Minimum charge, \$12.00.

300 to 600 kw. hours, 6 cents per kw. hr. Minimum charge, \$21.00.

600 to 1200 kw. hours, 4½ cents per kw. hr. Minimum charge, \$36.00.

Over 1200 kw. hours, 3½ cents per kw. hr. Minimum charge \$4.00.

Bills for power are subject to a discount of ten per cent. if paid within ten days and there is a minimum charge of 75 cents per horse power per month. The connected load at the present time is approximately 65,471 50-watt lamps and 2101¼ h.p. in motors.

For street lighting there are installed 185 arc lamps and twenty-five 250 watt tungsten series incandescents. Included in the 185 arc lamps is an installation of 75 Westinghouse magnetite arc lamps operated by mercury arc rectifier and constant current transformer. This installation will shortly be duplicated, another equipment now being on order. All other arcs are of the enclosed type operated by constant current transformers. It is expected that an installation of "White Way" illumination will be made on some of the principal streets at an early date, although it has not yet been decided whether to install tungsten standards or luminous arcs.

The following table is a summary of the additions made to the connected load each year since 1905:—

	Equivalent 50 watt lamps connected during year.	H. P. of motor connected dur- ing year.
1906	20,000	200
1907	8,553	65
1908	4,940	91
1909	6,004	78
1910	8,671	322½
1911	10,222	541¾
1912 (7 months only)	7,081	803

A further interesting insight into the growth of the Electric Light & Power Department is obtained by a perusal of the following comparative statement of that department's revenue for the years 1908, 1909, 1910, and 1911.

	1908	1909	1910	1911
Sale of Electric Light	\$89,267.59	\$103,839.56	\$110,230.72	\$170,096.65
Sale of Electric Power				23,163.18
Street lighting		9,046.05	11,102.90	11,000.80
Nernst lamp renewals		582.35	435.90	119.00
Inspection and application fees	1,039.80	1,377.15	1,601.50	2,569.04
Profit on jobbing and sale of mdse		590.40	1,579.08	3,060.10
	\$ 90,307.39	\$115,435.51	\$154,950.08	\$213,614.77

The Electric Light & Power Department is in charge of Mr. A. W. Ormsby. He is to be congratulated on the showing made by his department, which for the past year gives a surplus of \$24,949.54 on the year's operation.

Saskatoon

The construction of the street railway of the City of Saskatoon is being carried on by Messrs. Stone & Webster, of Boston, on a percentage basis under the supervision of Mr. Townsend, local manager.

The system will consist of twelve miles of track, four miles of which will have eighty pound 7-in. rails (these are used on all paved streets) and eight miles of standard sixty-pound rails. Three miles of this, representing one and a half miles of street, are double tracked. The rails are laid on cedar ties embedded in cement pavement on all paved streets, joints are all bonded with expanded bonds, each rail being drilled, and stud of copper bond compressed in drilled hole. The system is to be double tracked across the traffic bridge crossing the Saskatchewan River to the Nutana side. This bridge has recently been taken over by the city from the government, for this purpose.

The trolley wire will be No. 4 round, hard drawn copper supported on the one hundred foot streets, on standard arms and round steel poles placed in the centre of the streets, and on sixty-foot streets, in the usual method, by guy wires supported on cedar posts at curb.

Twelve single truck motor passenger cars being supplied by the St. Louis Car Company, will measure 34 ft. 4 in. over bumpers, 21 ft. 4 in. over corner posts, and will be equipped with electric heaters, electric bell ringer system, reversible rattan cross seats, headlights, window guards, storm sash, curtains, hand straps, registers, destination signs, trolley catchers, life guard and truck scrapers, mounted on the St. Louis No. 72 single truck.

The car barn, situated on the west side over the C.P.R. tracks, is 90 feet by 160 feet, one storey high, with six tracks. The office, quarters for the men, and repair outfits are also located in same. Power will be obtained from the new city power house on the corner of Avenue A and Spadina Crescent, where there will be two 300 kw., Westinghouse motor generator sets installed. The sets consist each of a 2200 volt, 2-phase induction motor, direct-connected to a 300 kw., 600 volt, direct-current generator.

The cars will run on a fifteen-minute schedule in the outlying district and seven and a half minute schedule in centre of the city. Messrs. Stone & Webster started construction the middle of July, and expect to have the system completed and in operation by the middle of December.

Brandon

The city of Brandon purchase their power from the Brandon Electric Light Company for their street lights, and other uses, the power being generated on the Little Saskatchewan river, at a point about ten miles north-west of the city. Transmission is at a pressure of ten thousand volts, which is reduced in the city's own power station.

Brandon has recently erected approximately four hundred ornamental lighting standards in the central portion of the city. The standards are five light type equipped with four 60 watt Mazda lamps and one 100 Mazda lamp, enclosed in four 12 inch Alba globes and one 16 inch Alba globe. The standards are arranged in suitable groups and operating on 110 volt circuit, being fed from 10 kw. transformer and controlled from switches on a convenient pole, so that the police may turn the lights on at dusk, the five light clusters burning from dusk till midnight, and the 100 watt lamp burning from midnight till daylight, which arrangement is said to meet with entire satisfaction.

That the future of Brandon promises to be very bright and prosperous is evident from the fact that this year the city arranged to build a municipally owned street car system, construction work on which was started in early spring. To date there is some five miles of steel laid. The system is to be in operation early in 1913, at which time Brandon citizens will have a very complete car service.

At the present time there are about one hundred and fifty electricians working in the city and there are three electrical contracting companies.

Medicine Hat

The city of Medicine Hat have just placed a contract for the equipment of their new power house and filter plant with Messrs. Fraser & Chalmers, Ltd., Montreal, Messrs. Siemens Bros. Dynamo Works, Limited, acting as sub-contractors for the whole of the electrical machinery and apparatus.

This equipment consists briefly of the following items:

Two "Rateau" steam turbines, 3600 r.p.m.; two three-phase turbo-generators, each 750 k.v.a., 3600 r.p.m.; one "Terry" steam turbine, 2600 r.p.m.; one d.c. turbo-exciter

35 kw., 2600 r.p.m.; complete condensing plant; one motor driven exciter set 50 kw.; one main switchboard, 2200 volt, with generator, exciter and feeder panels; three 100 kv.a. transformers, 2200/110-220 volts; three 50 kv.a. transformers, 2200/110-220 volts; two 325 h.p., 1200 r.p.m. motor driven high-lift centrifugal pumps; one pump motor switchboard; auxiliary motor equipment; one switchboard for equipment; lead covered cable connections between various parts of the plant.

The steam turbines and condensing plant will be manufactured at Messrs. Fraser & Chalmers Works, and the electrical equipment at Siemens Works, Stafford, England. The whole of the above equipment is being supplied in accordance with specifications prepared by Mr. R. S. Lea, Montreal, who is acting as consulting engineer.

Port Arthur

A report recently submitted to council by Utilities Commissioner J. J. Hackney showed that every department of the public utilities of Port Arthur is now on a profit-making basis. This is in marked contrast to the result of a year ago when the financial condition of Port Arthur's utilities was anything but satisfactory and the commissioner is to be congratulated on the remarkably satisfactory showing for the past year.

The net surplus for the three months ending June 30,

1912, in the different departments is as follows: Electric light, \$4,353; power, \$2,866; telephone, \$103; water works, \$82. For the first six months of the year the net gain on all utilities totals \$11,598 as compared with a loss of \$4,426 for the corresponding six months of 1911 when the Electric Light Department was the only one showing surplus. In the matter of power the gain has been most marked representing a turn-over during the year from a deficit of \$15,849 for the first six months of 1911 to a surplus of \$3,703 for the first six months of 1912.

Canora

The town of Canora, Sask., is installing an electric light and power system. The plant consists of one standard pattern Willans & Robinson Diesel oil engine of 96 h.p. when running at 240 r.p.m., coupled direct to 3 phase, 2200 volt, 60 cycle alternator. The exciter is also direct coupled making a very compact and neat machine. The output of the alternator is 63 kw. The following fuel consumption figures are guaranteed,—Full load, .47; $\frac{3}{4}$ load, .49; $\frac{1}{2}$ load, .57. The contract also covers the installation of a 400 gallon fuel tank, oil filter, circulating water pump, and other details. The installation and starting up of this machine will be carried out by the Northwestern Electric Ltd., Regina, this being the second Diesel engine driven plant the company has installed this year.

Montreal and Eastern Canada

Electrical Installation in the Elevator System of the Harbor Commissioners of Montreal

The Harbor Commissioners of Montreal, consisting of Major George W. Stephens, President, Mr. C. C. Ballantype, and Mr. L. E. Geoffrion, with Mr. David Seath, Secretary of the Commission, have developed the grain handling facilities of that port, until it now ranks as the best equipped in the world. The plant is fireproof throughout, and at present consists of two grain elevators with two marine legs each, and a system of conveyors by which grain can be delivered from either elevator to any of fifteen steamship berths. The combined storage capacity of the elevators is 3,620,000 bushels. Grain may be received from cars at a rate of 33,000 bushels per hour, and at the same time from boats at 55,000 bushels per hour; and may be shipped by the conveyors to ocean steamships at their regular berths at an hourly rate of 150,000 bushels.

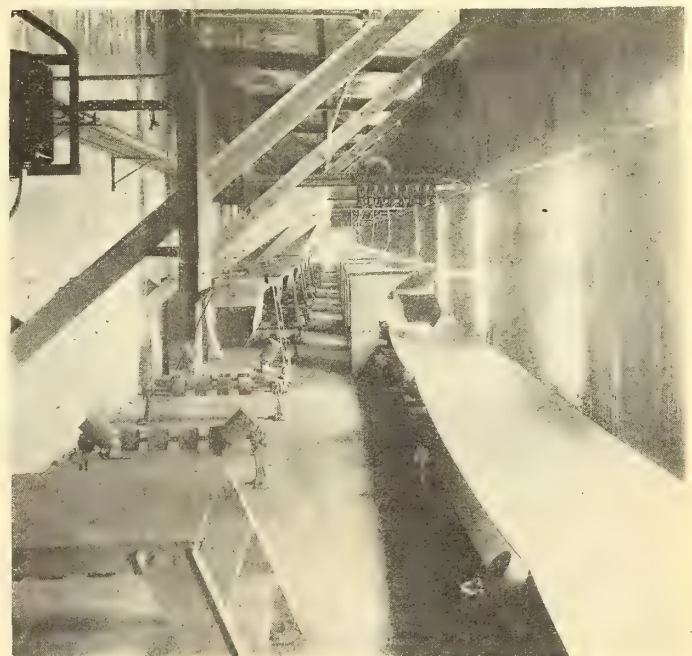
The plant is electrically driven throughout by three-phase, 60-cycle, 550 volt squirrel cage induction motors, the units ranging in size from 5 to 125 h.p. The installed motor horse power in Elevator No. 1 is 1,000; in Elevator No. 2, 3,435, and in the conveyor system, 3,030, making a total of 7,465. The system is lighted by approximately 2,000 incandescent lamps.

The installation of the electrical equipment in Elevator No. 2 and the new galleries is just nearing completion. Current is delivered by the Montreal Light, Heat & Power Company from their underground system to the elevator transformer house at a pressure of 2,200 volts. It is stepped down through three 1000 kv.a. water-cooled and three 25 kv.a. self-cooled transformers to 550 and 220 volts respectively for motors and lights. Distribution throughout the elevator and galleries is made by rubber covered and braided cable run in conduit. Main feeders are carried from the low tension switchboard to power panels located on the various floors of the elevator and in the towers of the conveyor system. From these panels, branch feeders are

taken to the motors. In each case the starting compensator is placed near the motor which it controls.

Two distinct telephone systems are used, one for Elevator No. 2 and one for the conveyor galleries. Each is of the intercommunicating metallic return type with centralized talking and ringing energy. There are 13 telephones in the elevator.

In the conveyor system there is a telephone station in each shipping gallery and tower. The tower station consists of a standard telephone giving communication with the other towers and with the elevators. Each gallery station



Belt conveyor, elevator No. 2—Montreal

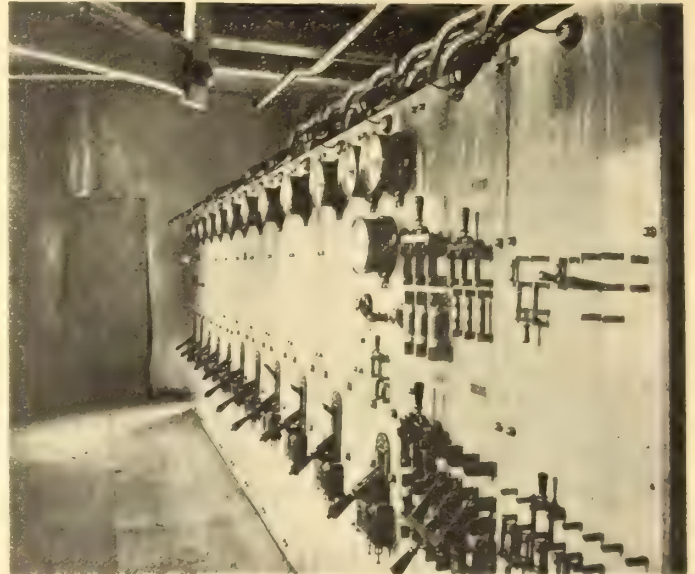
contacts of a number of telephone jacks and extension bells wired in multiple. One jack is placed at each ship-loading spout, the number of jacks in the different galleries varying between 14 and 19. Each of the twelve receiving legs in Elevator No. 2 has an independent signal system, consisting of a red and green light and two push buttons on the weighing floor in the cupola and a red and green light with one push button on the first floor. The two red and two green lights are connected in multiple, and so wired with the push buttons that when the red lights are turned off the green lights appear and vice versa. The man on the weighing floor can reverse the lights at will; but the man on the first floor can only turn off the green lights and turn on the red. This is done to guard against the first floor operator sending up grain before the weighman is ready to receive it.

The five shipping legs in the elevator are equipped with similar sets of signals; but as each leg is served by a pair of 5,000 pound automatic scales, an addition to the signal is necessary to take care of the automatic weighing feature. This consists of a blue light and bell on the weighing and first floors wired in multiple. When a shipment of grain is to be made the scales are set for the proper number of drafts necessary to make up the required amount. When the scales reach the tenth draft before the final, the blue lights show and the bells ring. When the final draft is made the scales automatically turn out the blue lights, turn on the red and stop weighing. The object of the blue light and bell is to notify the operators to stand by to shut off grain when the last draft is weighed. In addition to the above special signals, a complete system of speaking tubes, car puller signals, etc., is provided.

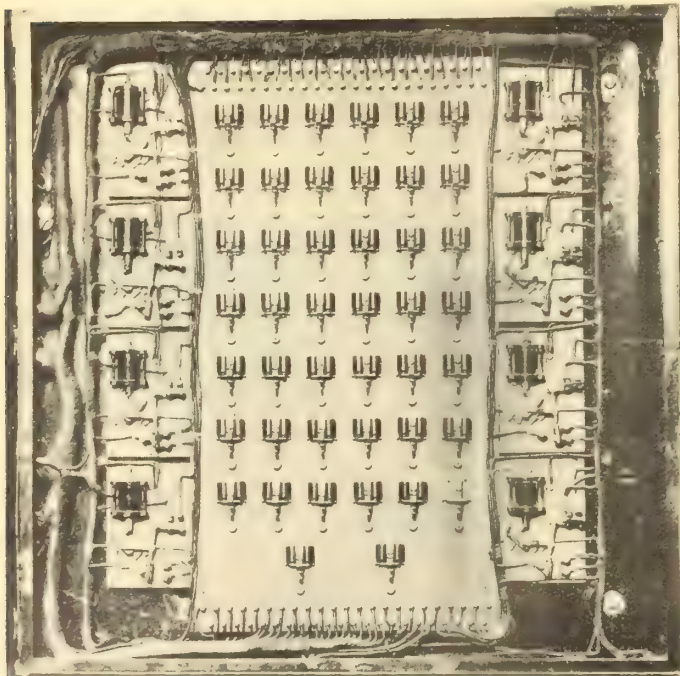
In general, the conveyor signal system is designed to operate a bell and light in series in the elevator and each tower between any particular conveyor belt and the elevator, the signals being operated by push buttons connected in

As the belts in galleries 7, 8, 9, 10, 11, 12, 13, 14 and 15 may receive grain direct from either No. 1 or No. 2 elevator, two independent systems of signals are installed. When grain is coming from No. 1 the signals are transmitted to that elevator, the numbers appearing on red globes; and when it is coming from No. 2 signals are transmitted to No. 2, the numbers appearing on green globes. As the installation of two pushes at each spout, one for No. 1 and one for No. 2, would lead to confusion and grain spills due to the operator pushing the wrong button, the following special interlocking system had to be installed in this portion of the conveyor system.

Normally the signals are dead. In the shore tower is a group of push buttons numbered to correspond to the



Main switchboard—elevator No. 2, Montreal



Relay panel for signals—elevator No. 2, Montreal

multiple and located at the shipping spouts served by that belt. The signal light is numbered to correspond with the belt from which the signal is sent. For instance, the operation of any one of the pushes along the belt in gallery No. 20 would cause the signal numbered "20" to appear in towers R, Q, P, O, and N, and in elevator No. 2.

belts. Each belt has two buttons, one for use if grain is coming from No. 1 and the other if it is coming from No. 2 elevator. When grain is to be delivered to a belt, the operator in this tower pushes the button corresponding to the belt and the elevator from which grain is expected, thereby energizing this set of signals, and enabling the operator at the belt to transmit signals in the usual manner. After having energized one set of signals for any belt, it is impossible for the shore tower man to energize the second set of signals for this belt until the first set has been restored to normal. This latter operation can only be performed by the man in the elevator from which grain is being sent. When the shipment is completed he de-energizes the system by a push button.

To save the cost of installing the heavy wires which would be required to carry the 110 volt current over the great distances to the various signals, each lamp is operated on a local 110 volt circuit through a relay, which is actuated by a 40-volt direct-current when the push buttons at the loading spouts are operated. The panel containing the relays for one group of signals and the magnetic switches for one set of interlocking pushes in one shore tower is shown in one of the illustrations.

The designing engineers on this work are John S. Metcalf Company, Limited, of Montreal and Chicago, under Mr. F. W. Cowie, chief engineer, and Mr. John Kennedy, consulting engineer for the Harbor Commissioners. The work of installation is being carried out by W. J. O'Leary & Company, of Montreal.

Mount Royal Tunnel

It will be several months before the Canadian Northern Railway decide on the system to be adopted for their electric line through the Mount Royal tunnel now being constructed. The plans of various systems are being studied by Mr. Brown, the chief engineer, and Mr. Lancaster, the electrical and mechanical engineer. In the meantime work is progressing at a good rate, an average of about 16 feet per day being maintained at the west end of the mountain, where the rock is being cut through. Operations have also been commenced at the city end, and at both portals a large number of electrical appliances have been installed. Work, in fact, is being done chiefly through electrical agency. At each end of the tunnel air is supplied by air compressors, consisting of a 2,200 cubic feet per minute compressor directly connected to a 400 h.p., 2,200 volt synchronous motor. In the same building there are three 1,100 cubic feet air compressors belted to 250 h.p. 2,200 volt induction motors. There are thus available 5,500 cubic feet of air at 100 pounds pressure to the square inch.

The current is purchased at 11,000 volts, and stepped down from the large motors to 2,200 volts and for the small motors to 550 volts. A very large number of small motors is employed for various purposes, including the running of a large machine shop, woodworking shop, and a rock-crushing plant, in which there are six motors from 75 h.p. downwards. For car hauling a 50 h.p. motor is employed, while at each portal and shaft a 25 h.p. motor is used for ventilation purposes. A shaft of 250 feet depth is being driven, and here a 100 h.p. motor is employed to drive a cage hoist. Electric pumps are also used at this shaft. It is probable that another shaft will be sunk at the city end, in order to expedite the work of construction.

Quebec R. L. H. & P. Annual

More than usual interest attached to the annual meeting of the Quebec Railway, Light, Heat & Power Company at Montreal, on Sept. 9, owing to the dissensions among the directors which resulted in the resignation of the four Paris directors and the reduction of the Board from 13 to 9 members. The meeting passed off quietly, Sir Rodolphe Forget, the president, obtaining the assent of the shareholders to his policy. The balance sheet showed gross earnings of \$1,415,825, an increase of \$135,799, while the operating expenses were \$734,925, an increase of \$73,000, net earnings from operation gaining about \$62,700. The gross income from all sources was better by \$146,000. Fixed charges, however increased \$204,000, leaving net \$215,120, showing a shrinkage of about \$58,000. Dividends absorbed \$203,900, leaving a surplus of \$11,200. The balance sheet indicates total assets of \$22,374,670.

On behalf of the French shareholders, Mr. S. G. Archibald asked for information as to the Quebec & Saguenay Railway, but the president declined to give any details on the ground that it was not to the interests of the company, adding that he hoped to see construction on this line resumed at an early date. He, moreover, said that the French faction working in opposition to the company, notwithstanding extensive advertising, had failed to secure more than 12,682 proxies out of 80,000 shares, and of these the Swiss shareholders had subsequently withdrawn 5,063. Sir Rodolphe added in regard to the resignation of the Paris directors, that while the directors of the company had received no salaries and no allowances for travelling expenses, demands had been made from Paris for salaries and fees. To these demands the board had declined to accede. He did not regret their resignations. The company had met all obligations. Reference was also made at the meeting to the association between the company and the Stadacona

Company, which has secured the hydraulic power at Seven Falls, about thirty miles from Quebec. It was explained that by a contract for the surplus output of this concern the Quebec Railway Co. placed itself in a commanding position in the market, having secured the power at \$17 per h.p. per annum, whereas it was considered that it would cost the competing company from \$25 to \$30 per h.p. per annum to raise power from steam. The manager, Mr. H. G. Matthews, also spoke of a large number of enquiries received by him of late for power for various purposes. Among these was an enquiry covering 3,000 h.p. for a pulp company at Sillery, and possibly for 1,500 for a powder mill; 500 in connection with the Bridge Company and a few thousand in connection with the proposed dry dock, all of which showed that Quebec was attracting considerable interest which would undoubtedly result in much larger earnings for the company ere a great length of time.

The following board were elected: Messrs. J. N. Green-shields, Hon. Robert MacKay, Hon. J. P. B. Casgrain, Paul Galibert, D. O. Lesperance, L. C. Marcoux and O. B. D'Aoust. The last three gentlemen take the place of Messrs. W. G. Ross, A. Haig Sims, and C. E. Dubord. Sir Rodolphe Forget was elected president, and Mr. Lorne C. Webster vice-president.

Montreal Tramways Company

It is imperative that the Montreal Tramways Company obtain additional tracks if they are to adequately deal with the increasing traffic. The company and the city council have not yet been able to get together in order to provide a remedy for the overcrowded condition of the cars, and Mr. Robert, president of the company, has now made a definite statement as to the requirements for an improved service. He suggests that Vitre street should be paved and widened for double tracks between Place Viger and Inspector street, and opened to Windsor street thus relieving Craig and St. James streets. The north and south traffic is growing at such a rate that it is absolutely necessary to open two more double track streets to relieve Park Avenue, St. Lawrence, St. Denis and Amherst streets. One street between Park avenue and St. Lawrence and one between St. Denis and Amherst would do this and satisfy the requirements for some time. Guy street should be widened and properly graded, so as to enable the company to establish another north and south artery to tap the back of the mountain district. This could not be done, as the street is at present, as the conditions as to grade, etc., are too dangerous to maintain an efficient service. The city should take steps to have a subway built under the Lachine canal and should have the G. T. R. tracks elevated, so as to enable the company to give the required service to the district south of the canal without the necessity of bringing people by way of McGill street. Under the present conditions, says Mr. Robert, a proper service cannot be given to this section, as delays at the canal and G. T. R. tracks make it impossible. The delay to the service during the month of August at the Wellington bridge were over 32 hours, and at the G. T. R. crossing in St. Henry about 16 hours. The recommendations made would also very materially benefit the general traffic of the city, especially the widening of Vitre street, the widening and grading of Guy street, the subway under the canal, and the elevation of the G. T. R. tracks. As to the streets required by the company to improve the service, the repeated demands of the company are already before the city. These suggestions, if carried out concurrently with such incidental improvements as may become necessary from time to time, would place the transportation problem in Montreal in a very satisfactory state for a considerable time and should be undertaken at once.

Ornamental Illumination of St. Catherine Street

The Montreal Underground Conduits Commission, having completed the plans for St. Catherine Street, have recommended a new lighting system, which will involve the removal of the wooden poles carrying the present arc lamps and the substitution of ornamental poles on that street. The present contract, dated December 5, 1910, between the Montreal Light, Heat & Power Company and the city for street lamps and circuits, states that the company will provide straight and round wooden poles. A new arrangement, will, therefore, have to be made with the company for new poles or the city will be obliged to provide such poles. There are now fifty-seven lamps in in St. Catherine street between Papineau avenue and Atwater avenue. The commission strongly recommends that the lighting of the thoroughfare be improved and brought up to modern ideas of street illumination. Three plans have been submitted, two being for arc lamps and the other for tungsten lights. One of the standards suggested is a combination pole for holding the trolley wires and supporting either an arc lamp or an incandescent lamp cluster. Mr. Parent, the superintendent of the city lighting department, is reporting on the plans.

St. Jerome Contracts Awarded

The Council of St. Jerome, P.Q., have awarded the entire contract for a hydro-electric power and lighting system to Allis-Chalmers-Bullock, Ltd., Messrs. Surveyor & Frigon, of Montreal, being the consulting engineers. The council have had a scheme before them for about a year, tenders being called for on two previous occasions, but from various causes the plans were not proceeded with. The plant will be situated on the North River, 3 miles from the town, where the power will be transformed and distributed. The scheme comprises a transmission line of 6,600 volts, high and low tension distribution systems, and street lighting. The equipment includes two turbines of 270 h.p. each, two generators and exciters of 150 kw. each, 3 step-down transformers, two 22 kw. constant current transformers, and 28 transformers for the distribution system. The street lighting will be a combination of arc and incandescent lights.

Quebec Electrical Association

Members of the Electrical Association of the Province of Quebec held the opening meeting of the season on Thursday, September 12th, at the Edinburgh Cafe, Montreal, Mr. Clarence Thomson presiding. Practically the whole of the evening was spent in discussing means to augment the membership and to improve the attendance at the meetings. The balance of opinion was in favor of developing the society by means of the weekly luncheons and by securing prominent speakers on general and interesting topics. It was stated there was a difficulty in securing adequate attendance at the monthly meetings, and as a result of the discussion a committee, consisting of Messrs. McGregor, Lachapelle, Smith, Parsons and Duncan, was appointed to revise the constitution by changing the monthly to annual meetings, and investing the executive committee with business powers. The report of the committee will be discussed at the next monthly meeting.

Autobus Franchise

Mr. Donald S. Robertson, private secretary to Mr. Robert (president of the Montreal Tramways Company), and purchasing agent of the company, has entered an action to prevent the city carrying out a contract entered into with the Canadian Autobus Company. The contract allows autobuses to run on certain Montreal streets, and gives the city

a large number of shares in the company, as well as two seats (one for a civic controller) on the board. Mr. Robertson is suing as a shareholder of the Tramways Company, and claims that under section No. 43 of by-law No. 40, the city is obliged to give the Street Railway Company the first chance of such a franchise as has been given to the Autobus Company. As a shareholder of the company, Mr. Robertson claims to have a vital interest in the matter.

Dorchester Electric Company

The generating station of the Dorchester Electric Company, Quebec, will be finished by November. It is to be a concrete and brick structure, 93 x 74 feet, and 34 feet in height. There will be steel framing under the switch board floor, and steel trusses will carry the roof. The foundation for the turbo-generators will consist of concrete, and the entire building will rest on concrete piles. Byers & Anglin, of Montreal, are the general contractors, while some of the sub-contractors are: steel work, Dominion Bridge Co.; concrete piling work, McArthur Concrete Piling Co., New York; ornamental ironwork, F. A. McKay, Montreal; chimney, Heincke Inc., New York.

Street Railway in Three Rivers

Tenders will be shortly called for the construction of a street railway system at Three Rivers, P.Q., the plans having been drawn up by a Quebec engineer. The charter empowers the company to lay tracks for thirty miles, but the present intention is to build five and a half miles within the city limits, taking in the Wayagamack Paper Works. The idea is to later extend the system to Cap de la Madeleine. The capital of the company is \$500,000, 75 per cent. of which is to be supplied by the city. The Mayor, Dr. Normand, is president of the company; Mr. Alf. Farmer, vice-president; Mr. L. T. Desaulniers, secretary; Mr. Lapointe, treasurer, with Coun. Robt. Ryan, Mr. Nap. Lamy, and Mr. L. Henri Nobert, on the board.

The Beauharnois Electric Company

The Beauharnois Electric Company, Ltd., has been incorporated at Quebec. It will have powers in the city of Montreal, and it is intended to supply current to towns in the counties of Laval, Jacques Cartier, Hochelaga, Laprairie, Chateaugay, Beauharnois, Two Mountains, Argen-teuil, Soulanges, Vaudreuil, Terrebonne, L'Assomption, Chambly, Huntingdon, Napierville, St. Jean and Iberville. Hydro-electric generating plants at different places may be constructed, but the company will also take power from the Canadian Light and Power Company, Montreal.

Power Plant on Jacques Cartier

The Donnacona Paper Company, Ltd., of Quebec, are installing a power plant at the mouth of the Jacques Cartier River, 35 miles west of Quebec City, for a 50 ton news print mill. The company propose to instal turbines of 6,000 horse power to be directly connected with wood pulp grinders, and probably turbines of 1500 to 2000 horse power directly connected to generators. The company will also instal motors of various sizes for driving machinery in different portions of the plant. A dam is being erected across the Jacques Cartier river.

The Imperial Wire and Cable Company, Montreal, have purchased from Shearer, Brown & Wills, lumber merchants and contractors, a block of land on Shearer, St. Patrick and Richardson streets, Montreal.

Grand'Mere Installing Plant

Allis-Chalmers-Bullock, Ltd., have secured the contract for the Grand'Mere, P.Q., municipal lighting and power system. The contract includes water wheels and all the electrical equipment, except the transmission line, which will be built by Mr. J. E. Thibideau, of St. Jerome. The agreement of Allis-Chalmers-Bullock, Ltd., provides for a 500 h.p. turbine, a 300 kw. generator and exciter, 6 100 kw. transformers for the distributing system, two switchboards, and wiring for the power house and sub-station. The contract for the power house has not yet been placed. Messrs. Surveyor & Frigon, of Montreal, are the engineers.

Miscellaneous

The Imperial Wire & Cable Company, Limited, Montreal, have received a contract to supply to the city of Winnipeg 100,000 ft. of paper insulated lead covered cable of 7500 volts working pressure. The company have also closed a contract with the Dorchester Electric Company, Quebec, for supplying and installing about 30,000 ft. of paper insulated lead covered power cable in connection with the new system of the Dorchester company.

During the next three years the Montreal Harbor Commissioners will spend six million dollars on improvements and new works. The programme includes the electrification of the harbor railway trackage as well as the terminals of the new Bickerdike pier. Several electric locomotives are to be purchased. Although the work has been decided on, no detailed plans have yet been made.

The shareholders of the Shawinigan Water & Power Company, Montreal, have decided to issue \$5,000,000 of new stock. The stock will be issued at such time as the directors deem it advisable. The directors have authorized the issue of one million of the five million dollars of new stock to the present shareholders at a price of \$120 per share.

The Algoma Steel Corporation are constructing a hydro-electric development plant at Magpie mine. The present capacity of machinery is 2000 horse power which will operate under a head of 60 feet. Power will be transmitted at 11,000 volts over an 18 mile three-phase line. When the capacity of the plant is increased, the transmission voltage will in all probability be raised to 22,000.

Mr. William T. Wilson, manager of the Dorchester Electric Company of Quebec, accompanied by Mr. W. D. Ballairge, city engineer of Quebec, has been on a visit to Boston and New York, in connection with the installation of Quebec city's ornamental street lighting system.

On Friday, September 13th, a water turbine in the No. 1 station of the Shawinigan Water & Power Company's plant burst, causing the death of one of the employees. The station was flooded by the bursting of the turbine. This unit furnished light to the district of Arthabaska, and caused a temporary dislocation in the supply.

Notes From the Maritime Provinces

The Eastern Car Company, Limited, of Nova Scotia, have commenced the erection of their extensive works at Trenton, N.S. When completed this plant will be used for the manufacture of all classes of street railway cars. The shops will be equipped with motor drives, orders having been recently placed with the Canadian General Electric Company for power house equipment comprising two three-phase, 60-cycle, 750 kw., 3,600 r.p.m., 600 volt Curtis steam

extraction turbines; one 25 kw., 3,600 r.p.m. turbine exciter set; one motor generator set of 200 kw. capacity on a.c. end; one motor generator set of 35 kw. capacity on a.c. end and one complete switchboard equipment. Mr. J. Lane is the consulting engineer, with headquarters at New Glasgow.

The St. John Railway Company are planning an addition to their power house equipment in the near future, and an order for new boilers has already been placed. This company is at present making a number of important extensions to their power and lighting lines. These include a nine-mile extension to Rothsay, which, when completed, will tap a well-populated suburban district. Another extension is to East St. John, connecting the Courtenay Bay improvement works.

At a recent meeting of the directors of the St. John Railway Company an application for increased wages from conductors and motormen was granted. The new schedule of wages mean an advance of $2\frac{1}{2}$ cents per hour for each man, the new rate being,—first six months, $18\frac{1}{2}$ cents per hour; second six months, $20\frac{1}{2}$ cents per hour; second year, $21\frac{1}{2}$ cents; third year and after, $23\frac{1}{2}$ cents. An additional 4 cents per hour will be paid for Sunday work.

Moirs Limited, biscuit and confectionery manufacturers of this city, have just completed a large addition to their factory. The building is of reinforced concrete throughout, and measures 190 by 60 feet and is eight storeys high, surmounted by a concrete frame work upon which rests a water tank of 40,000 gallons capacity. This, while being used at present for manufacturing purposes, will ultimately be used also to supply a sprinkler system for fire protection.

Heretofore the power used in the factory has been developed by a gas engine and producer plant, but these not being sufficiently large for present requirements, a Robb engine and boiler have been installed, and direct connected to a 150 kw. 3-phase Canadian General Electric generator. In addition to the lighting of the plant, a 220 volt motor will be installed on each floor, supplying power to the machines through a countershaft. All chocolate dipping tables will be electrically heated, fifty heaters being required for the purpose.

An auxiliary unit of 35 kw. capacity has been installed to take care of the load on Saturday nights, and other periods when the factory is not in operation. A refrigerating plant of fifty tons capacity is also being installed in the basement of the new building, and will be used in connection with the manufacture of this company's celebrated products. When completed, this will be one of the largest and most complete chocolate manufacturing plants in Canada.

Mr. Jas. Graham, for the past ten years well and favorably known to every central station man of the Maritime Provinces, in his capacity of erecting engineer for the Canadian General Electric Company, has accepted the position of general superintendent for the Yarmouth Street Railway Company, Yarmouth, N.S., and begins his new duties at once. This company at present operate a hydro-electric plant, having an 18-mile, 22000 volt transmission line, and are planning considerable further development.

The Cosmos Cotton Company, Yarmouth, N.S., have recently placed an order covering complete electrical equipment for new mills being erected at Yarmouth. This equipment comprises one 3-phase, 60 cycle, 550 volt, 750 kw., 3600 r.p.m., C. G. E. Curtis high pressure steam turbine, complete with switchboard and forty motors of various sizes. Lockwood Greene & Company, Boston, were the consulting engineers.

ELECTRIC RAILWAYS

Line Construction, Considered Under the Headings of Type, Material and Labor

By J. J. Martindale

Line construction may be divided into three divisions (with many sub-headings) as noted below:—

Type of construction.

Material.

Labor.

Type of Construction

The type of construction varies from single light bracket 2/0 trolley construction of the cheapest kind to 4-track heavy catenary design, and each type is best applicable to the service intended, so that overhead work is a subject which covers quite a field and no great detail can be given in an article of this length.

Line work as a rule receives too little attention in the ordinary street railway organization and such neglect is generally paid for in delays to service due to trolley breaks, trolley wires being out of alignment, curves being out of shape, etc. It is a department in which the electrical engineer can find plenty of opportunity to apply his ingenuity in solving difficulties and in which he can develop an efficient organization with which to eliminate these above mentioned troubles.

Single bracket construction with poles high enough to carry high tension lines and one to three feeders is the usual interurban design. The poles should be 35 feet in length and set six feet in the ground and have the usual three high tension wires on the land side of pole while one of the three feeders may be placed on 90 or 100 foot centres (on curves, of course, placed much closer) and telephone wires of No. 10 B. W. G., B. B. iron wire strung on wooden brackets (with a rolling transposition every five or ten poles) on track side under trolley brackets.

This design first of all places the "Hot Stuff" away from the linemen's reach when making ordinary repairs on the trolley wire, places the feeders where feed taps can be easily made to the trolley wire and where they can readily be worked upon, locates the telephone wires (the most frequent cause of trouble) near the ground and withal allows the use of a "Fish pole" connection for telephone service. By the installation of the rolling transposition telephone construction the telephone wires can be strung at small expense and the numerous joints in the wires due to the usual transposition at cross arms are eliminated and therefore the service is greatly improved.

The "Fish pole" connection is particularly useful if the cars are equipped with portable telephones, as it enables the motorman to communicate with his despatcher on any part of the line whether he be at a siding or not, and such construction has been particularly valuable at times of accidents or lack of power. The use of two trolley wires is advantageous as all siding overhead pan troubles are eliminated and if a wire falls on a distant section (without feeder) and does not lie on the rail, the service is not crippled.

For double track service the span wire type is most desirable. This construction allows the use of one 30-foot or 35-foot and one 35-foot or 40-foot pole, the larger pole to carry high tension lines and the smaller pole to carry telephone and feeder wires and at the same time requires greater care in setting the poles as the strains are much greater than on the bracket type.

Lightning arresters should be spaced four or five poles

to the mile connected to feeder taps and well grounded to the moist earth at foot of pole and to both rails of the track, all connections in the ground being galvanized pipe. The use of galvanized pipe eliminates the broken ground connections which are caused by the action of the earth on copper wire and the main point in lightning arrester installation and maintenance is to keep the ground connection in A1 condition.

Feed taps should be placed at least every one-quarter mile and made of 2/0 flexible weatherproof copper. This spacing should be decreased in hilly country or where traffic is heavy. The writer has frequently seen feed taps so far separated as to cause the loss of five to fifteen volts in the voltage at the car, which loss on a hill is most important with a frequent heavy service. City construction requires the placing of feed taps at much more frequent intervals and in large cities the same are placed approximately every 500 feet.

Catenary construction has been used in the past principally for a.c. work, but there is no doubt it will be used in the future on d.c. as well as a.c. installations, as it permits such an easy "underrun" for high speed trolley wheels or bows and practically eliminates trolley wire breakages. This design is, of course, more expensive than the ordinary type and can only be used in special cases such as those from light brackets to the heavy bridge type and may have different kinds of suspensions.

Material

Material should be of the best obtainable and it is an exceptionally foolish custom for railroads to buy the cheapest overhead material they can purchase. It is getting to be the practice among the larger properties to have a fully equipped testing department in which all the material purchased is tested to see if it conforms to the company's engineers' specifications, and there is no doubt but that such practice is productive of particularly good construction, and economy.

A wooden pole is, of course, the standard pole in use except in cities, where iron poles should be placed and set in concrete. All wooden poles should be painted at the butt with a preservative paint and should have an extra coat of paint at the ground line to prevent rotting. In any type of wooden pole construction, the tamping is most important and it is here that the ordinary lineman shirks his work as he very seldom cares or watches how his men proportion their labor in tamping poles.

One shoveller to three tampers is the proper ratio, but as it is sometimes difficult to use four men around the pole, one shoveller to two tampers will give good results, providing the shoveller does not exert himself. In many soils it is advisable to use 3 in. x 10 in. x 36 in. "Breasters," and in some soils it is necessary to augment this construction by the use of a "heel," 24-in. long, placed on the land side of the pole at its base. But at any rate, poles should be allowed to set for a month if possible before a strain is put on them.

Trolley wire should be nothing less than 2/0 and should not be grooved except in the larger sizes. Of course, the grooved trolley wire allows of a very smooth underrunning surface and it is advisable to install same wherever possible.

Insulators should be of standard design using 3/8-in. stud for the lighter construction and 3/4-in. stud for the heavier construction, while brackets having a flexible support should always be purchased. It is poor economy to

buy just a length of pipe and support the trolley wire attached thereto, as such construction allows of no flexibility in the support and the whole overhead work is jarred at every suspension. All overhead material should be sherardized where possible, which includes such appliances as cross arm braces, bolts, insulators, etc., while the brackets can be japanned or painted black.

Labor

The majority of linemen are the most inefficient men in an electric railway organization and are also the hardest set of men to keep in working condition. This state of affairs is due to the natural character of the men in the line gang, as they are particularly independent and carefree, and also to the fact that their work is generally away from any but infrequent observation and inspection, so it is very easy to take advantage of such conditions. The only way to keep a line gang working to a high point of efficiency is to have them fill out quite a complete report stating their time consumed on different parts of the work, amount of material used, etc., and these reports should be carefully compared with the estimates of the work in hand. If the work is running over the estimate, the engineer in charge should investigate the reasons why, and it will generally be found that the line foreman has not properly prepared his men for the day's operation by having sufficient and proper material, and also that the men are loafing on the job.

Unmarried linemen are, as a rule, inefficient, and it is the desire of all conscientious engineers to obtain a set of men whose homes are established and who care something for their job and desire somewhat of a standing in the community in which they live.

Switzerland Electrifying Steam Roads

The electrifying of the entire system of government railways in Switzerland is a question that has been occupying the attention of the Federal Council for several years. The fact that Switzerland produces no coal makes the cost of fuel for operating steam roads an important item in government expenditures, and the further fact that the mountain streams make available a vast amount of water power for the generation of electricity, has encouraged the serious consideration of the proposition to electrify the railways. Water power in Switzerland is under government control. Several commissions have been appointed to investigate and report upon the practicability of the scheme, and the most feasible plan of changing the system. After a thorough investigation of the subject and some experiments, the commission has reported in favor of single-phase alternating current at 15,000 volts pressure. The first work to be undertaken in the application of electricity for propelling power in the state railways will be in the St. Gotthard route, where there are many steep grades and numerous tunnels, the longest of which is over nine miles. The change is especially desirable on this line as it will eliminate the disagreeable passage through many long tunnels filled with smoke.

It is estimated that the cost of the conversion of the entire government system, aggregating 1,700 miles, will be something like \$14,000,000, including water power for electrical generation, while the cost of operation would be reduced about 10 per cent. as compared with steam power. The recent opening of the Loetschberg tunnel, which is over nine miles long, establishes a new and important traffic outlet for Switzerland. It shortens the distance between London and Milan and other points in northern Italy by several hours, and when completed and equipped with electric motive power according to the plans, will prove an important branch of the transportation system of the Confederation.

Mr. F. Dresser has been appointed to the position of Dominion Inspector of Gas and Electricity, Victoria, B.C., succeeding Mr. Richard Jones.

Ontario West Shore Railway

Interested municipalities are discussing the advisability of obtaining control of the Ontario West Shore Railway and arranging for its completion and operation. It will be remembered that the construction of this road was undertaken by Mr. J. W. Moyes, and about 20 miles of track have been laid. For a time this road was operated by steam though it was the intention ultimately to equip it with a gas-electric service. No construction work has recently been done and the line is lying idle.

320 Stepless Cars

The New York Railways Company have applied to the Public Service Commission for permission to issue \$2,600,000 bonds for the purpose of improving their equipment. Of this amount it is reported \$1,600,000 is to be spent in building 320 stepless cars, the experiments on which have proven successful.

The city of Toronto received \$863,563 from the Toronto Railway Company as their share of the profit of the street railway operations for the year ending August 31, 1912. This is \$111,693 in excess of last year's percentage.

Personal Mention

Mr. W. F. Wright has been placed in charge of the Motor Sales Department of the Canadian General Electric Company, succeeding Mr. Erisman, resigned.

Mr. S. L. B. Lines, of the Chamberlain & Hookham Meter Company, Limited, Toronto, has just returned from an extended trip in the West of Canada and Japan, and has been successful in securing a number of large contracts for meters and time switches.

Mr. H. E. M. Kensit, who during the past four years has been employed in investigating and reporting on various undertakings and projects in Canada and the United States for the engineering firm of Smith, Kerry & Chace, has received an appointment with the Water Power Branch of the Department of the Interior, Ottawa.

Mr. Leonard Andrews, M. Inst. C.E., M.I.E.E., of London England, managing-director in England of the Canadian British Engineering Company, Limited, is paying a visit to Canada where he is to spend some six months assisting Mr. Martin, the company's managing-director in Canada in organizing and starting this new enterprise along the road to success.

Mr. F. Goodwyn has resigned his position with the Canadian Tungsten Lamp Company and will engage in business on his own account, locating most probably in Hamilton. Since Mr. Goodwyn took hold of the sales department of this company, some two years ago, it is reported that he has doubled the sales, and his guiding hand will be much missed. He starts on his new venture with every good wish for success.

Sons of Jove Rejuvenation

The Sons of Jove are making elaborate preparations for a big Rejuvenation on October 4th to be held at the King Edward Hotel, Toronto. To insure success, five committees have been formed on Entertainment, Reception, Membership, Hall and Paraphernalia respectively. Mr. Chas. A. Howe is chairman of the Entertainment committee; Mr. B. O. Salter of the Reception committee; Mr. Edwin E. Pike of the Membership committee; Mr. H. D. Howe of the Hall committee, and Mr. M. P. Ellis of the Paraphernalia and Degree Work committee.

A Meter Testing and Protective Device

A New Equipment which Greatly Simplifies the Testing of Meters in Service, with Many Other Attendant Advantages

Ever since the flat rate system gave way to the meter, the efforts of central station companies have been centered upon the most economical and practical method of testing meters. This, in order to secure absolute accuracy and fairness to both producers and consumers.

A new device has quite recently been perfected and is now being manufactured by the Metropolitan Engineering Company, of Brooklyn, N.Y., and Toronto, Canada, which provides a ready means for testing meters, protects the watt-hour meter and service wires from tampering and materially improves the appearance of the installation. In its latest form, produced after four or five years of develop-

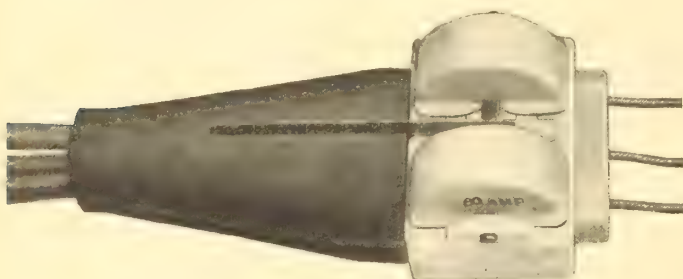


Fig. 1

ment, the meter testing cut-out combines in one simple device, the features of a meter service cut-out and an easy means for making all the electrical connections and combinations necessary for testing, inspecting, or changing any meter with which it is installed.

The meter testing cut-out makes possible the following improved methods:—(1) Allows the meter inspector to test for creeping or leak by inserting a properly connected plug in the testing clips. (2) Permits the changing of a meter without shutting down or disturbing the customer's load by the insertion of a plug. (3) With the use of a similar plug performs the following operations preparatory to testing a meter, in their proper order and in a negligible length of time;—(a) By-passes the customer's load, irrespective of the amount of energy flowing at the time, without disturbing the polarity or continuity of the current supply in any way, and without any arcing at the plug or cut-out. (b) Connects the meter fields in series, where this method of test is used. (c) Gives the proper leads to the rotating standard and the artificial load through a cable connected to the plug.

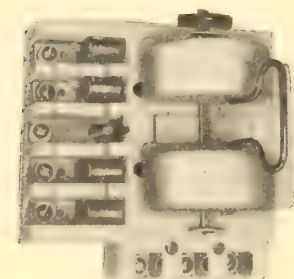


Fig. 2

It is impossible for the tester to open the customer's load without either removing or blowing the fuses or disconnecting some of the permanent wiring of the meter. By this method of testing none of the permanent wires are touched, which eliminates all possibility of blowing fuses or meters and also assures unaltered polarity. This latter is quite essential where poly-phase meters are used in connection with motors or arc lamps.

This system has met with the approval of central station managers and operators who have examined it, and already has been installed by a number of the largest companies in

the United States and Canada. Among these is the Commonwealth Edison Company of Chicago, who have decided to equip all their services with these devices and have recently given orders for them, aggregating nearly a million dollars. They are already in use on all the services of the New York Edison Company of New York, and of the Edison Illuminating Company of Brooklyn and many other companies in the United States. In Canada one of the largest companies to adopt the devices is the Toronto Electric Light Company, who have recently decided to install them on many of their large services. Orders have also been received from Vancouver, Winnipeg, Ottawa and Hamilton, and among the more recent orders is one from the Toronto Hydro-Electric Commission. A description of the apparatus is given below.

With modern metal conduit installation there are now only two points where the leading-in wires are exposed—at the wall entrance where it is necessary to install a fuse, and at the meter, where the terminals must be accessible for tests. Protective devices are therefore installed at these two points. Fig. 1 illustrates part of the installation at the leading-in point. The metal conduit enclosing the three leading-in wires shown to the left of the figure threads into a conical shaped steel casing which in turn fits snugly over an extension of the porcelain block similar to that shown on the right side of the block. The three wires to the right of Fig. 1 pass to the meter, being protected again in exactly the same manner by a conical steel casing threaded to the metal conduit. Fuses are contained in the semi-circular, hermetically-sealed, porcelain enclosure shown. After placing in position, the fuse blocks and the two metal casings are securely locked together. Even in the choice of the lock great ingenuity has been shown, a design having been adopted which it is impossible to open without breaking a

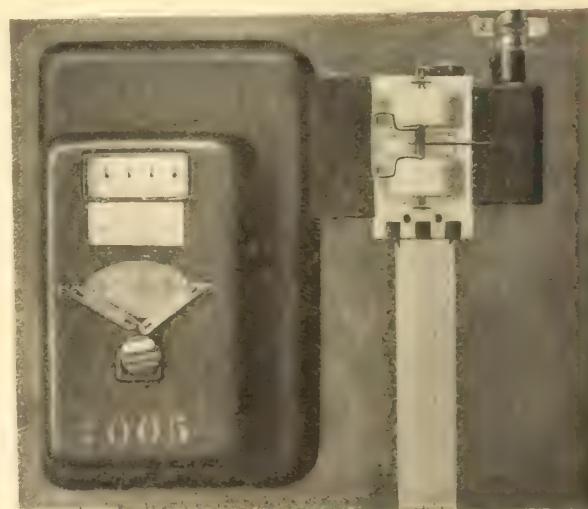


Fig. 3

small porcelain button which the customer can have no means of replacing. The handle shown in Fig. 1 is for removing the fuse plugs after unlocking, by which arrangement both or all lines become unconnected at the same instant. It will be seen that this installation protects, absolutely, the wires on both sides of the fuse block.

At the point where the meter is installed, a porcelain

block of somewhat similar design is again used. Various types are available and choice of the most suitable depends on the conditions under which service is being supplied. In Fig. 2 a block designed for 3-wire distribution is shown. In this figure the wires enter the block from the conduit at the right hand side. Connection is made with the meters at the five binding posts on the left side and distribution is made from the three posts at the bottom. This block is shown assembled with protective devices in Fig. 3. The entrance wires are protected as before by a steel casing into which the conduit threads and which fits over a protecting flange on the porcelain block and is securely locked in place. All exposed parts between the block and the meter are enclosed, first by a steel casing which covers the five-block terminals shown, Fig. 2, and then by a second casing so cut that it fits snugly over the meter, enclosing all the meter terminals and connecting wires. These latter casings are finally locked together to the wall and to the meter. Fig. 3 indicates, therefore, that no point on the whole service



Fig. 4

is left exposed except where the current, having passed through the meter, leaves the porcelain block to supply the customer.

The lock, which represents the climax of security in this protective equipment, is composed of three separate parts, Fig. 4, a brass shell, a spring steel wire, and a porcelain button. When secured in place, this wire cannot be removed except by first breaking the porcelain button. As the button cannot be used over again it is evident that the seal cannot be tampered with without detection following.

Meter Testing

Though providing absolute protection to the company from theft this apparatus has been devised principally to supply a simple arrangement by which the customer's meter may be tested much more quickly and simply than under the old arrangement. Fig. 2 shows four spring contacts which under ordinary service conditions carry the current without interruption. In Fig. 5 is shown a test block with four plugs, each of which plugs consists of two metal strips separated by a hard rubber insulator. This test block is a part of the testing equipment and remains permanently wired to the testing meter or rotating standard and the necessary resistance load. By inserting this block of plugs in

the spring contacts described above the apparatus is all ready for the test. With this simple insertion the meter is cut out of the customer's circuit and placed in series with the testing equipment without in any way interfering with the customer's current, which is short circuited across the meter terminals. The customer's supply is therefore not interfered with even momentarily, and though the meter is, as at present, cut out during the test, the time required to make and unmake the connection and perform the test is much shorter than formerly, as is, therefore, the length

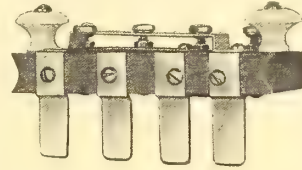


Fig. 5

of time the customer is getting his current free. The test also requires only one man, thus representing a further saving. In preparation for this test, it will be seen that all it is necessary to do is to remove the lock which secures the two steel casings to the left of the porcelain block in Fig. 2, and remove these casings, thus leaving the required terminals exposed.

The actual wiring connections can be understood best by reference to the three line drawings in Fig. 6. The first drawing represents ordinary service conditions with the protective device installed; the second shows the testing plug, wired up with the artificial load and the standard measuring instrument; the third indicates the different connections when the plugs are inserted and the test being made.

In (1) the service wires are shown entering at the top of the testing block. The two outer wires only are fused, that to the left passing through the spring contact described earlier, then through the current coil of the meter, back through a second spring contact and out to the house service. The course of the line to the right of the three is shown similarly in the drawing. The current in the middle wire divides in the testing block, part passing to the meter and part to the house-main direct. The drawing (2) indi-

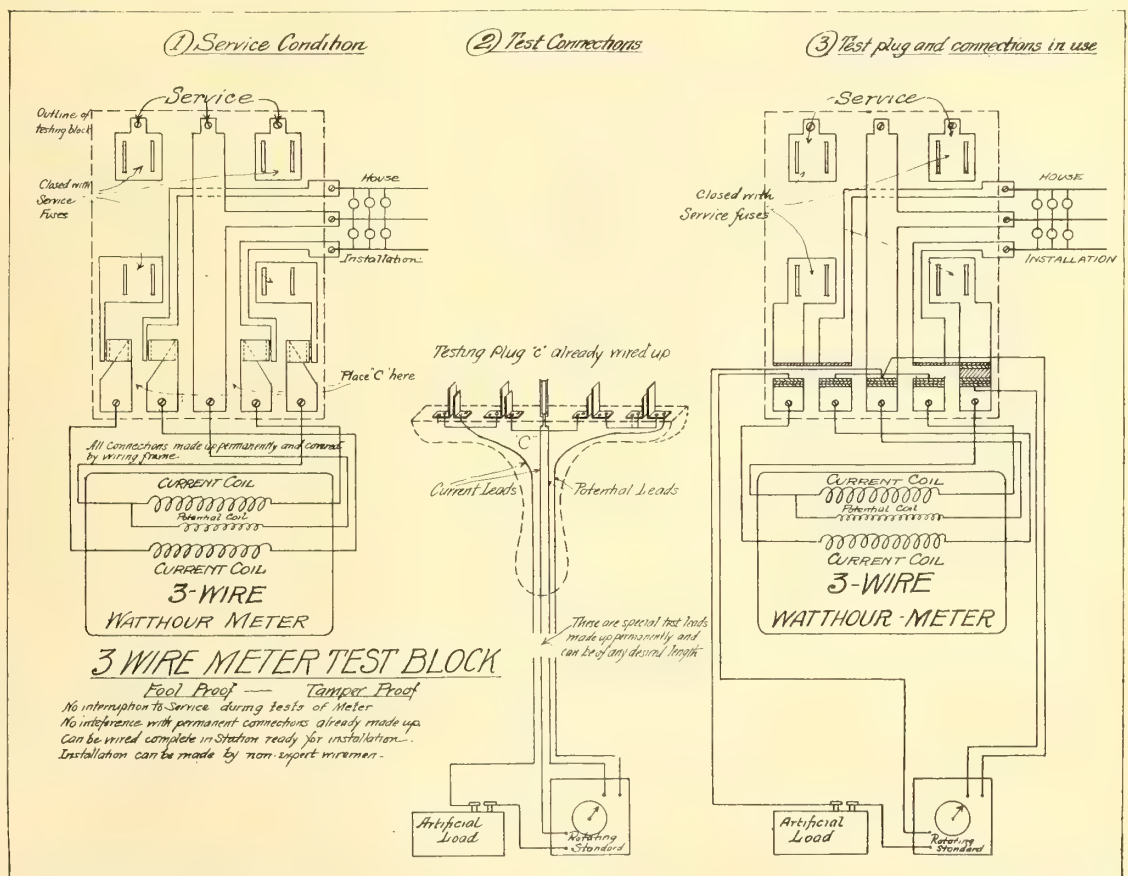


Fig. 6

note that each of the four plugs is in two parts, the air space shown representing the dielectric. The dotted outline is an insulating handle used on certain types of these blocks. Ordinarily these blocks remain permanently wired to the testing equipment and just ready for use.

The paths of the current when the testing plugs have been inserted in the spring contacts in the porcelain testing block are shown in (3). The two outside service wires are short circuited as shown and pass direct to the customer's distributing mains without passing through the meter; the centre line was already direct connected to the customer. By a study of the current paths as shown in (3) it is seen that the customer's meter and the testing equipment are connected in series ready for test, current being supplied to the meters in the sketch from only two of the three lines (the two on the right). However, if deemed advisable from any cause whatever, the position of the plugs can be reversed and a test made on the two lines on the left side.

A type of plug fuse sometimes substituted for the one described above is that shown in Fig. 7. This may be used up to requirements not exceeding 30 amperes at 125 volts.



Fig. 7

This type of plug fuse is made with slotted head through which a chain may be passed for sealing. Where this type of fuse is used at the meter its smaller size allows of the block being completely covered in with a steel casing as indicated in Fig. 8.

The meter and protective devices may be assembled and wired in advance and sent to the customer's premises ready for connection to the service. This is an advantage in that it eliminates any extensive installation work on the premises of a customer, and it also permits the wiring and assembling to be done in the supply department, at a time convenient to the central station and by other than expert wiremen.

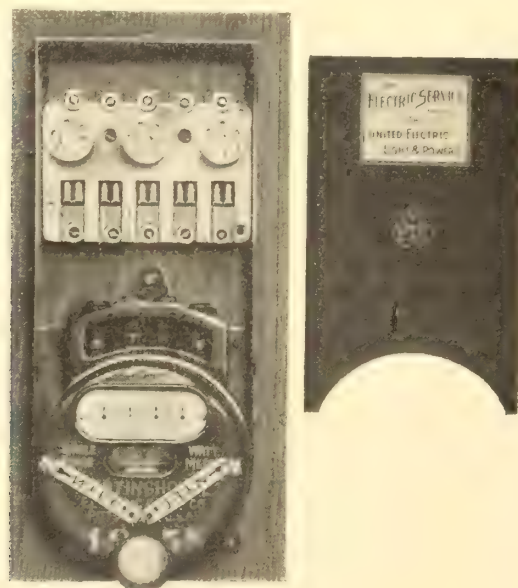


Fig. 8

Summed up, the advantages that may be claimed for this new system would appear to be the following:—

- (1) Provides an easy means of testing the meter.
- (2) Continuity of customers' current not interfered with.
- (3) No chance of changing the polarity of the service.
- (4) Meters may be changed without service interruption and without attendant dangers of working with live wires.
- (5) Tests can be made in much shorter time.

(6) Time shorter during which customers' receive free current.

(7) Reduces installation labor charges.

(8) Reduces testing labor charges.

(9) Prevents stealing of current.

This equipment has, up to the present time, been manufactured in Brooklyn, N.Y., but a Canadian company has been formed and the manufacture of these devices commenced in Toronto, by the Metropolitan Engineering Company, who already have sufficient orders on hand to tax their facilities to the limit for some time to come. The Canadian business will be under the management of Mr. J. C. Noice.

Wireless on Great Lakes

As a result of the recent International Wireless Congress held in London, the Canadian Government may make wireless equipment of lake and ocean-going vessels compulsory. At the present time many of the vessels plying on the Great Lakes are not equipped with wireless apparatus, the chief reason in the past having been that there was little land communication available. New stations have, however, been opened at Midland and Tobermory, and there will shortly be a station at the Soo. Midland will command the Georgian Bay westward, while Tobermory will command the same water eastward and also Lake Huron. The Soo station when completed will have a range all over Lake Superior to Port Arthur, and at an early date the present station at the latter point will be superseded by more up-to-date equipment. It is expected that within a short time the chain will be completed through to Kingston, whence connection will be made to the east coast stations. Work is already started on the station at Point Edward. When the chain is completed vessels with even short-range apparatus will be in touch with one or the other of the land stations practically all the time. Already a number of the C. P. R. boats are being equipped, and it is probable that many of the other companies will voluntarily install wireless apparatus.

Proposed Rules and Regulations for Inside Work

The Hydro-electric Commission of Ontario have issued in detail proposed rules and regulations to govern the installation of all inside electric work throughout Ontario, whether this work is in charge of municipal or private interests. Before placing these regulations in force, a number of booklets are being distributed to associations, societies and individuals interested, with a request for suggestions and helpful criticisms.

It will be remembered that the commission has been given power by the Ontario Government to formulate and enforce such a set of rules and the recent appointment of Mr. H. F. Strickland, former chief inspector, Canadian Fire Underwriters' Association, as supervisor of this department, indicates the determination of the Commission to make practical use of the power vested in them by the government. It will be found that the proposed rules as now sent out are framed largely along the lines of the National Code with such additions and variations as have been considered advisable under conditions existing in Ontario.

The question of properly drawn rules and regulations and the later question of their enforcement is of great importance and it is hoped that all interested persons will take early action either in approving the rules as they are now printed or in advancing helpful suggestions and criticisms for their improvement.

The Nov. 1 issue of the Electrical News will be specially devoted to matters pertaining to electric railway construction and operation.

The Illumination of Small Stores

A Discussion of Present Practice in Small Store Lighting with Tungsten Lamps—Some Valuable Remedial Suggestions

By Clarence L. Law and A. L. Powell*

The purpose of this paper is not to present any new ideas on a particular phase of lighting, but rather to give the results of a recent investigation of the lighting of small stores carried on under our direction. The object in collecting the data here given was as follows. We know that there are thousands upon thousands of small stores throughout the country, any of which is typical of its class. In the main, these are not of sufficient importance to be treated separately or individually by the illuminating engineer. Therefore, if a set of approximate rules could be put in the hands of the central station or manufacturer's solicitor, with the aid of which he could intelligently design such lighting installations, a distinct step should be made in the advancement of the art of illumination.

Since, as we have suggested, it seems somewhat desirable to standardize the practice in small store lighting, and knowing that this can best be done by the method of averages, we proceeded to determine the present state of the art and to interpret the observed values. Another point which must be recognized, is the fact that any individual case compared with the average is liable to be deficient and one must apply his experience to values like those recorded in this paper if he would attain the best practice.

With this end in view, over eight hundred small stores were visited in New York City, Newark, and the adjoining towns. In order that the installations investigated should represent average conditions throughout the country, only stores on the less prominent avenues and cross streets were visited. Fifth Avenue, Broadway, 14th, 23rd, 42nd, 125th streets, New York, Broad and Market streets, Newark, and like streets were carefully avoided as not typical of the small stores through the country. The shops along Fifth Avenue, and the like, although small in dimensions, cater to such an exclusive class that individuality of treatment is essential in their illumination. The stores along some of the other avenues mentioned are apt to produce a blaze of light for the advertising value rather than to illuminate their stores and hence are not typical of our classification. Corner stores were not included as it was apparent that their standards were invariably higher than the stores located along the block, due to the tendency toward display lighting.

At each store, the following facts were noted and carefully tabulated; address, type and nationality of the proprietor; dimensions of the store; number of lamps; class, clear or bowl-frosted; reflector equipment; arrangement of lamps; watts per square foot; color of ceiling; color of walls; height of ceiling; height of lamps. Show window: number of lamps; arrangement; wattage; class, etc.; reflector and general remarks. All these data were taken in order to afford a means of ferreting out errors and discrepancies.

For the purpose of simplifying the issue of our investigations, the results were obtained in watts per square foot, on account of the similarity of the units and because this value serves roughly as an indication of the cost and, with close approximation, the quantity of light. These values could not be applied to arc lamps or other electric illuminants; they are based on the use of tungsten filament lamps and efficient reflectors.

One fact which was apparent in almost all these stores is that the show window lighting helps the lighting in the

fore part of the store interior. There is usually no dividing partition between the store and the window. Hence the values given for watts per square foot, which take into account only the units in the store proper, would be low if the window were separated from the store by an opaque wall.

The wattage required for any desired intensity in store lighting will naturally be higher if the illumination is necessary on the side walls rather than on a horizontal plane. The recommended values in the table given further on are based on the assumption that a reflector of relatively high efficiency will be used, and, of course, should be modified if some purely decorative shade is adopted, or if indirect or semi-indirect lighting systems are installed.

The brief discussion given below applies to store lighting in general and although this topic has been discussed before, we believe it will bear repetition.

Store lighting is of primary importance, for the successful storekeeper must be up-to-date and progressive in all phases of his business. In this age of competition, particularly in the retail lines, to be ultimately successful the shopkeeper must carefully scrutinize every detail of his store layout, and business methods. That is, his store must be arranged to attract the public; then, when he has their trade, he must keep it. There must be nothing which will tend to displease customers and cause them to go elsewhere. Just as his clerks must be courteous in order to retain the patronage of the public, so must his lighting be arranged with the same object. Not only must there be the correct quality and quantity of light to insure an advantageous presentation of goods, but there must be no discomfort arising from the lighting system, such as eye fatigue, which may cause the customer to go where he or she can shop in comfort. The system must also be such that the cost to produce the desired effect is at a minimum, thus keeping down that eternal bugbear, overhead charges.

Three primary factors entering into the consideration of store lighting are: (1) intensity, (2) color, (3) even distribution of light.

The small store proprietor is usually limited as to the amount of money he can spend for lighting, and hence the psychological and artistic sides of the layout are, in a measure, out of the question. The light sources should be efficient and the system permit of an economic maintenance.

Intensity

It is a well-known fact that there is a certain range of desirable intensity of illumination for each class of work in a factory; similarly, there are certain desirable ranges for different goods on display at the various stores. It is often remarked that modern illumination brings out bad qualities in the goods. This is sometimes true, but these defects are at once recognized as inherent in the materials themselves, rather than as a fault of the lighting. Here the engineer is in a quandary. Shall he show up these faults to the prospective purchaser, or shall he render them unnoticeable? The latter condition is sometimes imperative, as he is working primarily in the interest of the owner of the store. For instance, we encountered a second-hand furniture dealer in the poorer section of New York. This merchant was rabid in his fancied objection to the tungsten lamp—it showed too readily the imperfections of his

*Presented at the Illuminating Engineering Society Convention, Niagara Falls, Ont., Sept. 16-19, 1912.

goods. The only difficulty was that he had too high an intensity of illumination, and on using a smaller size unit obtained satisfaction. Of course, in the average store the intensity should be such that it brings out the good qualities perfectly. It is obvious, for example, that a black gas range will require a different intensity of light than a piece of white dress goods.

Color of Light

While in the large department stores the color of the light is of some importance, in the class of stores mentioned in this paper there is so little matching of goods, that we may safely avoid a discussion of it. In point of fact, many of the large store proprietors have adopted tungsten filament lamps throughout, which, though they do not give an absolutely pure white light, afford a close approximation to it and are suitable for most purposes. Moreover, the cheerful appearance of the whole building when lighted with these lamps is an attractive feature.

Even Distribution of Light

Light distribution is one of the essential factors to be considered in designing a lighting installation for a store. Deep shadows should be avoided, and all places where the goods are on display should have an equal share of the total flux of light. We can readily accomplish this by the proper spacing, height and choice of reflectors. The method of determining these conditions is too well understood to warrant giving the details here.

Classes of Small Stores

Art Stores.—The walls on which the pictures are hung form the planes of illumination. Preferably these should be specially lighted to the desired intensity with a low value of general illumination for the center of the store. This, however, involves considerable additional expense of installation and maintenance and rarely finds application in the small store.

If the store is of medium width two rows of relatively small units (40-60 watt), equipped with bowl shaped opalescent or prismatic reflectors giving an intensive distribution are applicable. Both the diffused and the direct light give even illumination over the picture surfaces and there is sufficient general illumination. If the store is very narrow and one row of units is adequate, the lamps should be equipped with a distributing type reflector and hung high. Comfort is desirable in viewing the exhibition; glare should be especially avoided; bowl-frosted lamps are necessary. The average watt per square foot found was 1.0. We believe this value to be a trifle low to give good results; 1.3 watts per square foot is recommended.

Bakeries.—The counters and pie racks require the illumination. A mirror is usually found in the rear of the counter the reflection from which assists the lighting. A single row of light units located in the center of the store serves very well. These may be small and located on multi-arm fixtures, or larger on single stems. Reflectors should be bowl shaped and give an extensive distribution. The average watts per square foot found was 0.82. As the ceilings and walls are usually light and clean this is a good working value.

Barber Shops.—The faces of the patrons furnish the plane of illumination; and as the patrons are forced to lie back and gaze upon the ceiling, light diffused as much as possible is desirable. The row of chairs is usually located about two feet from under a center row of lights and there is considerable glare if a clear lamp with a prismatic reflector is used. A mirror is almost invariably located in front of the chairs and this tends to neutralize the effect of the deep colored wall papers which are used to a great extent in the cheaper shops. One 60-watt bowl frosted

tungsten lamp equipped with an opalescent or frosted prismatic reflector giving an intensive distribution, hung about 7 feet 6 inches from the floor, placed between each two chairs even with the top of the back will give an excellent light for hair cutting; and, for shaving, the maximum light will be on the under part of the patron's chin. There will be sufficient diffuse light for general illumination. The average watts per square foot found (general illumination) was 1.23. This is about correct for such an installation but the localized arrangement is to be preferred.

Cigar Stores.—Show cases or shelves occupy at least one wall. The paper or wall is usually dark, tending to increase the wattage necessary to properly illuminate the store. While the discernment of detail is not so very necessary, the dark color of the goods and their low reflecting power also add to the light required. The planes of illumination are the counters and show cases. Medium sized tungsten lamps with opalescent or prismatic, bowl or flared, reflectors located over the counter serve well. The average watts per square foot was 1.45. This is a good working value, as these stores are very small in size and a pleasing appearance is essential.

Clothing Stores.—The walls of this type of store are usually lined with hanging suits or show cases; these as well as the center portion of the store must be lighted to permit inspection of the goods. Although the clear prismatic reflector is usually found in conjunction with the tungsten lamp the frosted prismatic or opalescent reflector is to be preferred on account of the greater diffusion or "softness" of light. A row of large units singly, or smaller units grouped on fixtures, is suitable, with a local light for the mirror. The goods are to a large extent very dark and require more than the usual amount of light. We recommend raising the value of the average watts per square foot found, 1.37, to 1.5.

Confectionery Stores.—These stores are usually as showy as possible and decorative fixtures predominate. Mirrors and shelves occupy nearly all the wall space. Quite frequently decorative wall brackets are placed alongside of the mirrors. The shades (it is hardly possible to call them reflectors) used in the average confectionery store are purely decorative. Clear lamps and a blaze of light seem to be desired. In lighting these places the ideas of the owner should be given due consideration; if a decorative system is demanded the most efficient system that accomplishes this end should be used. Multi-arm fixtures with a number of small units are popular and are usually equally spaced in a row between the two counters. Good results should be obtained using about one watt per square foot; the average found was 0.97.

Delicatessen Stores.—The stores of this class are usually very narrow and are best lighted by a single row of light units located over the counter. An extensive type of reflector should be used as the shelves and show cases which occupy both side walls are the principal planes of illumination with the counter as a secondary consideration. The average watts per square foot found was 1.1. This value will give a cheerful and well lighted store.

Drug Stores.—Here the walls are lined with shelves holding bottles and packages. The labels must be read easily. The tables and counters must also have a fair amount of illumination. The stores are of medium width and are best lighted by two rows of units using reflectors giving an intensive distribution. Sufficient diffused light will thus be provided for the shelves in addition to well distributed downward flux. The average watts per square foot found was 1.0. We believe this value a trifle low and would recommend using 1.2 watts per square foot in calculations.

Dry Goods.—Very frequently in the small store of this kind goods hang from the center of the ceiling, and shelves line all sides of the store. A general illumination of a relatively high intensity for the little color matching which is done, is necessary. The counter forms the plane of illumination, as all inspection of goods is done there. A good lighting arrangement for two counters is a row of small lamps with intensive reflectors over each, furnishing localized general illumination. If the center of the room is occupied by a table, general illumination from a multi-arm fixture is applicable. The average watts per square foot was 1.26. On account of the large percentage of white material on the shelves and hanging about the store, good results could be obtained with 1.0 watt per square foot.

Florists' Stores.—A good arrangement is general illumination localized on the show cases. This is the more economical arrangement, as the intensity in the main portion of the store need not be high. Lamps with prismatic or opalescent reflectors of an artistic type serve well. The average watts per square foot found was 1.0. If only general illumination is used, this figure is suitable. If show case lighting is installed 0.5 watt per square foot is sufficient for general illumination.

Haberdashery Stores.—As is the case in a number of other instances, a higher intensity of illumination is found in the front portion of the store, as most of the purchasing is done there and this arrangement also has some advertising value. Bowl reflectors of the intensive type spaced to give an even illumination on the counter plane serve very well. The average watts per square foot found was 1.43; this average is a good working value.

Grocery Stores.—The shelves and counters here demand an equal amount of the light; and if the store is very narrow one row of single units using a wide angle or flared reflector is suitable. For a medium width store, two rows of single smaller units with intensive opalescent or prismatic bowl reflectors should be used. The average watts per square foot was 0.98.

Jewelry Stores.—Direct light of high intensity should illuminate the counter. Lamps with intensive prismatic reflectors, located in a row over the counter will accomplish the desired result, and there will be sufficient diffused illumination to light the show cases usually found in the rear of the counter. Clear lamps with opalescent or other diffusing reflectors will give a brilliant light and permit the jewels to sparkle. Another arrangement is the use of crystal glass fixtures hung high, furnishing a brilliant general illumination. 1.54 average watts per square foot is good practice.

Meat Markets.—The walls on which the meat racks are located are the surfaces to be lighted, hence a single row of lamps equipped with distributing reflectors, hung about 9 feet is necessary, or two rows of lamps with bowl shaped intensive reflectors; these arrangements will provide sufficient direct light for the counter. A local light must be provided for the ice box, and it is well to have a small lamp wired in series with this lamp, on the outside of the box to serve as a signal lamp. The cashier's desk should also have a small local light. 0.9 average watt per square foot is satisfactory.

Millinery Stores.—The hats are displayed in high glass cases lining the walls, but all close inspection is done in the center of the room. Two rows of lamps with intensive reflectors will serve very well in lighting the show cases, and at the same time provide good light for inspection. In the narrow store a single row of lamps with intensive reflectors is applicable. 1.3 watts per square foot is a very good working average.

Music Stores.—Shelves with boxes line the walls. The contents of the boxes are indicated by writing or printing on the face of the box. The light for this kind of store

must be of a moderately high intensity and the reflector equipment for the arrangement chosen should give a wide distribution of light. 1.05 average watts per square foot will serve as a basis for making calculations.

Restaurants.—The tables are the places on which illumination is desired. The intensity of the illumination should be sufficient to permit one to read easily. Although the ceiling is usually white, the walls are frequently covered with a rather dark paper; occasionally they are, however, interspersed with mirrors. The dark walls require a wattage slightly higher than normal for a given illumination. The room should be laid out in the regular manner for an even distribution on the working plane. As a rule restaurants are wider than most small stores; two rows of lamps are usually necessary. The average watts per square foot required is 1.1.

Shoe Stores.—The plane of illumination here is about one foot above the floor, and there are secondary planes which are the surfaces of the boxes lining the walls. Sufficient light must strike these to enable the clerk to read the labels. Two rows of lamps with intensive reflectors serves very well. The customers' bench is usually located in the center of the room between the rows. Clear lamps are best as a direct light seems to make the leather appear to better advantage. A machine is usually found in the rear. It requires a local light with a proper steel reflector. The average watts per square foot required is 1.0.

Wine and Liquor Stores.—Barrels occupy the rear portion of the store; shelves, with bottles, are on the sides. The fixtures are usually decorative, and there is no definite plane of illumination, as the shelves and counter demand equal amounts. A distributing or extensive reflector is applicable. 1.2 average watts per square foot, the average found, is slightly high; 1.0 is a better working value.

General Conclusions

From the few samples given above one may make the following classification and specifications for small stores:

1. Those stores which demand equal illumination on the side wall shelves and on the counters, such as bakeries, china, delicatessen, drug and grocery stores and meat markets. If a store is of medium width, two rows of lamps with intensive reflectors, or one row of multi-light fixtures with wide arms will be satisfactory; if narrow, one row of lamps with extensive reflectors. The medium width stores we have in mind average about 20 feet; their lengths vary; 50 feet may be considered the maximum length. Some of the smaller stores occupy only half a city lot and are approximately 9 feet wide and stores of this width come under the narrow classification.

2. Those which demand good illumination on the counters with a smaller amount of light flux on the side walls, such as cigar, dry goods, fish, haberdashery, jewelry, pawn broker and stationery stores, rows of relatively small lamps with intensive reflectors providing localized illumination with reference to the counters, serves well.

3. Those stores which demand the highest intensity on the wall surfaces and a low general illumination. Art, music, hardware and paint stores fall in this class. Two rows of relatively small lamps with intensive reflectors located close to the wall, or if very narrow, one row of lamps with distributing reflectors.

4. Those which demand diffuse general illumination. In this class are clothing, confectionery, florist, furniture, novelty, millinery, tailor, shoe, trunks and leather, wine and liquor stores, and restaurants. Decorative fixtures and equipment, or simple units arranged for even illumination on the theoretical working plane may be provided.

5. Those stores the illumination of which is a localized lighting proposition, as in barber shops, hair-dressing and manicuring parlors.

Industrial Progress and Trade Notes

Trade Publication

Veritys Ltd.—Publication No. 693. Canadian Edition, describing Aston electric meters of various kinds. This firm makes a specialty of house service meters.

W. T. Glover & Company—Pamphlet illustrating this firm's whipcord braided flexible cable for use in mines, factories and workshops. This is a particularly serviceable form of cable providing all the desired mechanical properties at a minimum cost, while its water-resisting finish renders it particularly adaptable for use in damp surroundings.

Pass & Seymour—Catalogue No. 20, issued by Pass & Seymour, Inc., Solvay, New York, descriptive of electrical wiring devices manufactured by this company. This catalogue has been made as complete as possible both as to illustrations and descriptive matter, so that all the information required by customers with reference to P. & S. devices will be readily available.

Modern Welded Pipe.—Pamphlet published by the National Tube Co. of Pittsburgh, Pa., describing and illustrating the manufacture of modern welded pipe. The book contains, besides a short history of this industry, much up-to-date information relative to modern tubular products. A section of particular interest is that relating to pipe threading dies, also that regarding comparative results of the relative corrosion of wrought iron and steel.

Small Electric Sets.—pamphlet No. 120 issued by the Canadian Union Electric Co., Ltd., Montreal, descriptive of gasoline driven electric light and power sets. These sets range from about $\frac{1}{2}$ up to 35 horse power and are especially adapted for installation in large private houses, public buildings, country homes, logging camps, hotels, etc. Not only can all types of lighting be supplied but heating, cooking, warming and the operation of agricultural or other light machinery can be attended to.

Lidgerwood Cableways—A descriptive booklet issued by the Lidgerwood Manufacturing Company, of New York, through their Canadian agents, Allis-Chalmers-Bullock, Montreal, descriptive of cableways for hoisting and conveying. This particular section of the cableway catalogue shows typical installations, splendidly illustrated, of cableways for building dams and locks. The illustrations include a number of scenes of the Panama Canal construction work with many other equally interesting installations.

Westinghouse—The Westinghouse Electric & Manufacturing Company have issued leaflet No. 3506, describing motors for pulp-mill service; leaflet No. 2444, describing equalizer fly-wheel hoisting sets; leaflet No. 2457, covering commutating pulley rotary converters; leaflet 2359-A, describing type S.K. D.C. commutating pulley motors. These pamphlets are all illustrated and contain much helpful information relative to the various topics discussed. The same firm has just distributed the No. 10 issue of "Small Motors," which is devoted to several interesting stories of experiences enjoyed by people with motors in the home.

Mr. F. W. Hollingsworth, of the Canadian Tungsten Lamp Company, is in Vancouver and expects to stay there for some time on account of the number of promising prospects he has run into. He has had a very successful trip through British Columbia, and reports prospects bright.

Exhibits at the Canadian National

Exhibits of electrical equipment at the recent Canadian National Exhibition engaged an unusual amount of attention and interest indicating a more universal recognition of the modern possibilities of electric energy. The general result was however, marred as usual by the scattered location of the exhibits. There are comparatively few people attending this exhibition who can take time to pass down every aisle of every building, even if he were interested in doing so. The result undoubtedly is that many electrical men having neither the time to institute a systematic search, nor the instincts of a Sherlock Holmes, get a very inadequate idea of the magnitude and variety of the electrical exhibition. That it is merely a matter for concerted action on the part of the exhibitors is indicated by this year's gas display which was all under one roof and which created a correspondingly favorable impression. That the added effectiveness to the electrical display would be equally marked there seems little room for question and we believe it will be a mistake if definite action is not taken in the matter before another year. Considered as so many units the displays left little room for criticism, the artistic arrangement of the booths and the beauty and utility of the equipment making them the most attractive exhibits on the grounds to the majority of the visitors. Below are brief notes of the exhibits of more special interest.

The Northern Electric & Manufacturing Company, Toronto, displayed interphones, rural phones and police patrol and fire alarm systems. They had also a sample line of electric basters, etc., and specially featured the "Detroit," a luminous heater.

The Northern Aluminum Company's exhibit in the Industrial Building comprised useful household and labor-saving aluminum kitchen utensils. Some of the most practical and attractive of these were the egg-poacher combination, triplicate saucepans, tea kettle and double boiler, and the coffee biggins.

The Canadian H. W. Johns-Manville Company, Toronto, were exhibiting "subway junction boxes" similar to those they are supplying to the city of Toronto. They were also showing their "Noark" brand of high tension fuses with a capacity of 44,000 volts, and their fibre conduit underground insulator.

The Canadian Boving Co. Ltd., Toronto, were exhibitors in the Machinery Hall. Their most prominent exhibit was a pump suitable for supplying water to towns. This pump had a capacity of 15,000 imperial gallons per hour against a 65 foot head. The engine running it was of Swedish make, a "Diesel" crude-oil engine, for which they claim the cost of oil consumption is about $\frac{1}{2}$ cent per h.p. hour.

The Positive Clutch & Pulley Works, Toronto, were showing varieties of friction clutches, and wood split pulleys. The special clutches were: gas engine friction clutch, positive combined jaw and friction clutch, transmission jaw and friction clutch.

The Wm. Hamilton Co. Ltd., Peterboro, were exhibiting the "Samson" turbine in Machinery Hall. This turbine is adapted to all water power requirements and is especially suited for direct connection to electrical generators. This was the only turbine exhibited on the grounds and we believe the first in the history of the Canadian National Exhibition.

The Schaeffer & Budenburg Manufacturing Co., Brook-

lyn, N. Y., were showing a full line of gauges, comprising instruments ranging in size from $\frac{1}{2}$ to 24 inches and covering all purposes where pressure, vacuum, or draft is to be measured.

The Canadian National Carbon Co., Toronto, exhibited the "Columbia" brand of batteries, including the "Columbia" track battery for railway signal work. They also displayed arc light carbons, carbon brushes, and specialties for telephone work.

The Norton Telephone Co., Toronto, were exhibiting their auto-phone system of private phones which does away with a switchboard operator. They also showed "Gill" selectors for train despatching, as used by the C. P. R.

The Toronto Electric Light Co. occupied a large space in the Industrial Building. Among some of their special exhibits were a luminous radiator which supplies heating and light at the same time and can be fixed to any circuit, an electric grill which is a combination boiler, toaster and frying pan, and a disc stove with a three heat adjustment.

The Canadian Independent Telephone Co., Toronto, were exhibiting varieties of switchboard systems, among others, the rural lines system which does away with switch buttons. They were also showing a central energy switchboard for larger systems.

The James Morrison Brass Manufacturing Co., Toronto, were making a special feature of the "Dolphin" cut glass shade, besides showing a large variety of fixtures, lamps and concealed light domes.

The Canadian Carbon Co., Toronto, exhibited in the Transportation Building. They were showing a full line of X-Cell batteries, flash lights, etc. This company are now offering a "nine-lives" spark plug coil which is manufactured entirely in Canada.

The Gibson Electric Vehicle Co., Toronto, exhibited a Hupp-Yeats coupe of 12 horse power.

The Flanders Electric Vehicle Co. Ltd., Toronto, were showing a colonial coupe of 12 horse power. This car they claim will run from 75 to 100 miles on a single charge at a cost of 75c.

The Peck Electric Ltd., Toronto, were exhibiting two handsome coupe cars, one of which has a 112-in. wheel base. This car is operated by a direct drive with 4 to 1 reduction gear, and has one of the longest wheel bases for this type of car on the market. The absence of a chain renders the operation of the car absolutely noiseless. This company offers a special price of \$30 a month covering charging, cleaning, minor repairs and delivery. This company also manufacture large trucks with a capacity of from 1000 lbs. to $7\frac{1}{2}$ tons.

The Goldie & McCulloch Co., Galt., Ont., were exhibiting as their chief line, a bankers safe with a double chronometer safe adjustment and time clock. This device makes it impossible for the safe to be opened unless three people are in collusion. This company's stand was finely decorated in honor of H.R.H. the Duke of Connaught.

The Crown Electrical Manufacturing Co., Brantford, Ont., had an attractive exhibit of novelties, chiefly showers. Their Flemish finish shades were in great favor. This entire exhibit was purchased by the F. C. Burroughs Furniture Co., Toronto.

The Canadian Tungsten Lamp Co., Hamilton, were situated in the Industrial Building and were exhibiting a large variety of study lamps. One of the features of this exhibit was a lamp display as formerly shown in the Paris Exposition.

The National Electric Heating Co. Ltd., were showing mantle type radiators with two buttons for a whole or half fire; also tailors' irons; and an air heater.

The Radiant Electric Company, Limited, Grimsby, were exhibitors of a complete line of stove trimmings and a new style percolator. They also had an electric warming

pad which is proving very popular and is taking the place of the hot water bottle.

The British Aluminium Company, Toronto, occupied space in the Industrial Building. Some of the aluminium utilities they were showing were aluminium nails for boat building; aluminium matting for automobiles, and aluminium electric cables.

The Stromberg-Carlson Telephone Manufacturing Company, Toronto, were exhibiting factory inter-communicating equipment, private branch exchange switchboards with a common battery exchange, suitable for hotels, etc.; iron-clad weather-proof mine telephones; "Deffone" phones for the deaf; and rural and farm line telephones.

W. H. Banfield & Sons, Toronto, were exhibiting a varied and beautiful assortment of chandelier chains, together with a large range of fitting pans, and parts.

The McDonald & Willson Company, Toronto, were showing some very handsome new designs in "semi-indirect" for parlors and living rooms, and crystal electroliers for drawing rooms. This company are specializing in finishes this season, and had a very handsome assortment on view.

Keiths Limited, Toronto, were specially featuring showers, of which they had one of the largest assortments in the Exhibition. They were also showing several styles of indirect lighting, which they claim is meeting with great favor this season.

The Ontario May-Oatway Fire Alarms, Toronto, have a new fire extinguisher named "Pyrene." They claim that this is the only extinguisher which is passed by the Underwriters' Association, that it will not freeze in the severest weather and will not damage in any way the most delicate materials.

Chapman & Walker, Toronto, Ont., were exhibiting the celebrated Lancashire motors, and a Bergmann motor generator. They were giving a demonstration of a three-phase 500 volt, 25 cycle Bergmann motor driving a direct current $1\frac{1}{4}$ kilowatt, 50 volt generator.

The Irving Electrical Supply Company, Toronto, were making a special exhibit of Excello arc lamps. They were also showing the "Premium" vacuum cleaner which is entirely made in Canada, a vibrating chair which is recommended by the medical profession; and an electric iron made in Canada.

Jones & Glassco, Montreal, had an exhibit of "Skefko" self-aligning ball bearings; Kenyons, "P.I" cotton driving rope, and general driving and silent roller chains.

Jones & Moore Electric Company, Toronto, were exhibiting "Pelouze" heating irons, "Century" single-phase motors and the J. & M. three-phase, 25 cycle power motors, one horse power up to fifty horse power, also the split-phase invincible Century motors.

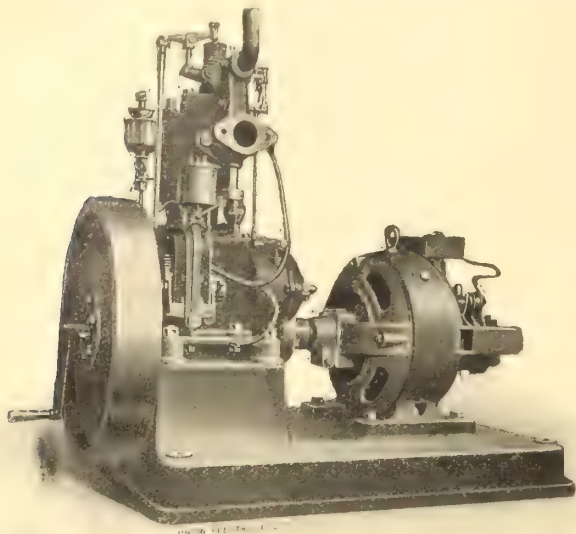
The Hydro-Electric Commission of Ontario occupied a large space. They were giving a special exhibit for the benefit of farmers, and had worked out a chart as an example of how a three horse power portable motor might be occupied for a period of 24 hours. They are making a special inducement to farmers to pay a flat rate and this chart was for the purpose of pointing out the economy of such an arrangement. Everything used in this exhibit had been loaned to the Hydro-Electric Commission by Toronto merchants.

Death & Watson, Toronto, had a prominent location in the Transportation Building, where they were demonstrating mercury-arc rectifiers for charging storage batteries.

The Toronto Hydro-electric System were exhibiting a number of cooking and heating implements. Their automatic electric range attracted much attention as did also a variety of grates, mantles, water heaters, and irons.

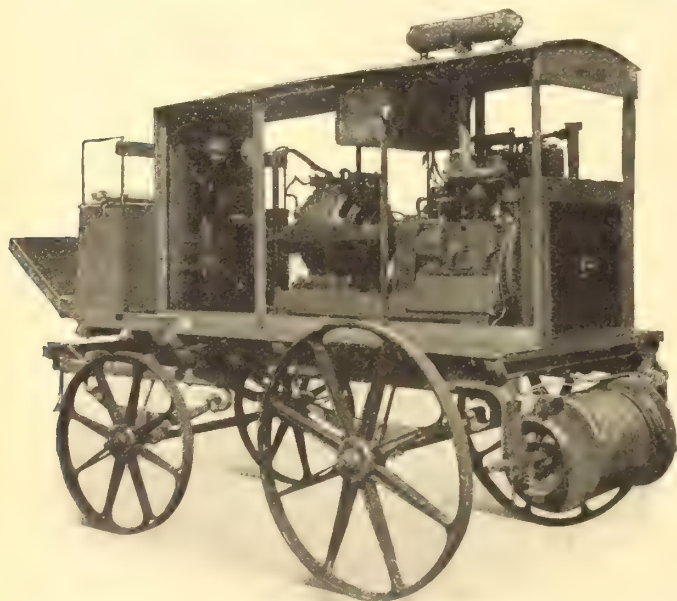
Isolated Electric Plants

Highly satisfactory results are now being obtained by the use of small individual electric generating plants of either stationary or movable type. A company that has specialized on this kind of equipment is the Canadian Union Electric Company, Ltd., of Montreal, who are placing on the market gasoline driven electric sets of various sizes,



suitable for large homes, public buildings or farms. These generating equipments may be obtained as small as half kilowatt capacity, equivalent to about 20-16 c.p. lamps, or as large as required.

A special feature is the portable set shown in one of the accompanying illustrations, which may be used for an almost innumerable number of purposes around the farm. The generators may be obtained wound for almost any voltage so that the low voltage tungsten lamps of high efficiency may be used. In this connection, a storage battery set is quite often installed, by the use of which the engine may



be shut down during certain hours when the load is not heavy or when it is intermittent, as for example during the night when only a few or possibly no lights at all may be required.

The practicability of an electric equipment of this type is unquestioned and no progressive farmer or resident of a rural community need be without the advantages of electric

light and power simply because he does not happen to live along one of the lines of the hydro-electric commission of Ontario.

Modern Motor Delivery

Though the value of storage battery vehicles in modern delivery work is recognized by those who have made closest study of the situation, a great deal of pioneer work yet remains to be done before the general public will grasp the idea that this latest type of motive power has really reached the stage of practical application. As in other lines the pioneers in the storage battery industry have done and are doing much and apparently thankless work in distributing information and blazing the way for the tremendous development that is certain to follow in this department of the electrical industry. It is only right, therefore, that we should be grateful to those who are spending much time and money in this educative work, the financial results of which have not as yet proven any too satisfactory. Among the firms who are spending much of their time and energy and money in this campaign of education is the General Vehicle Company, of Long Island City, New York, who have sent out a dozen or more of interesting catalogues dealing with different phases of the storage battery driven motor truck and electric cars of every description. These point out the many advantages of battery-driven vehicles for many classes of work, give figures of cost, maintenance, length of life and in general cover the subject in a very comprehensive way as may be seen from the following titles of the booklets mentioned:—Modern motor delivery; electric trucks in brewery transportation service; the dock type industrial truck; electric storage vans; the electric truck as an investment; the electric vehicle in commercial service; economics of delivery; strictly a business proposition; electric trucks for bottlers; operation and maintenance; electric wagons in postal service; brewery delivery by electric trucks; the real story of the electric truck. It is shown in these booklets that the operation of electric trucks is cheaper than the horse, that its capacity is much greater, that its operation is possible without skilled drivers, that the life is longer, that in crowded districts the space required for expeditious operation is much less and that the housing space required is much smaller.

The Engineering Works of Canada

A new company has been incorporated in Ottawa with the purpose of manufacturing electrical and mechanical apparatus of all kinds. Information given out states that the new company is closely connected to the "Societe Alsacienne de Constructions." The "Societe Alsacienne" operates three plants, one at Belfort in France and one plant each at Mulhausen and Grafenstaden in Germany. This company have installed numerous hydro-electric plants, and furnished complete steam plants. They have been active in building gas motors having, for instance, recently installed at Differdange the largest gas motor in Europe, using gas from a blast furnace. Recently also the company built a 15000 h.p. motor, direct current, for driving a reversible rolling mill, running at 60 r.p.m. and reversing 15 times per minute.

The new company has the right of use for Canada of all patents of the "Societe Alsacienne." It is the intention to build large shops in one of the industrial centres of Canada. Mr. J. E. Dalemont has charge of the affairs of the company. Mr. Dalemont is an electrical and mechanical engineer, and was formerly connected with the Department of Electrical Engineering of McGill University. He has also held leading positions with American and European concerns and has had a wide experience both technically and financially.

The Eye-Comfort System of Illumination

The National X-Ray Reflector Company has issued bulletin No. 3, describing approved methods for planning indirect lighting installations. The booklet explains step by step what measurements it is necessary to make, what outlets and where to install them, and deals with the subject of interior illumination in rooms used for various purposes in such a way as to indicate how the best results, both as to even distribution and pleasing appearance, may be obtained. This booklet should be of very great value to anyone who contemplates a new installation along modern and efficient lines. The same company are also distributing bulletins showing figures of tests made by a number of large firms who were dissatisfied with the results they were obtaining from other equipment they had already installed. Actual installations in different portions of the offices were made of four types of lighting as follows: (a) direct lighting with satin-finish prismatic reflectors; (b) semi-indirect lighting with inverted reflectors; (c) indirect lighting with porcelain enamel reflectors; (d) "Eye-comfort" system of indirect illumination. These trial installations were made in private offices, working spaces and draughting rooms and a thorough practical working test was given the different installations covering a period of seven months. Not only were the judgment and wishes of the actual workers taken into consideration, but first cost, current consumption, replacement of lamps and labor in cleaning were likewise considered. The actual figures obtained in the tests have not yet been made public but it is pointed out that these must have been conclusive as it was the almost unanimous desire of the employees and of the committee that a complete installation of the Eye-Comfort system of indirect illumination be made, which desire has since been carried out.

Royce & Company Expanding

Royce & Company, Limited, formerly located on Dundas street W., Toronto, are moving to a new factory site at 90 Sherbourne street, Toronto, where they will occupy the ground and first floors, comprising some 8,000 square feet of floor area, and where ample space will be obtainable for show rooms and demonstration purposes as well as for manufacturing. This firm, in addition to manufacturing the well-known "Economic" household electrical appliances, are also agents in Canada for Ferranti meters and switchboards.

The Holophane Co., Ltd.

Through the consolidation of the Holophane Company of Newark, Ohio and the Fostoria Glass Specialty Company of Fostoria, Ohio, under the name of the Nelite Works, Cleveland, Ohio. The Holophane Company Limited, Toronto, become distributors of all products of this company, comprising probably the most complete line of all kinds of lighting glassware, globes, and reflectors shown by any company. Their Holophane glass prismatic globes and reflectors are all Canadian made; this well known line has had so many additions the past year that it has outgrown the idea entertained by many that it was purely for commercial purposes, and now covers units that meet most artistic requirements for home, club, and hotel use. The Fostoria line embraces many of the most beautiful lines of lighting glassware made—the Iris, Veluria, Pyro, and a long line of cut and etched ware. The "Noblac" inner globes also stand very high in quality. The new Veluria "Urno-lite" is now made in the 12-in. and 15-in. sizes, and is one of the real clever things recently brought out for enclosed or non-direct lighting; other sizes will soon be on the market. The Holophane D'Olier line of green enameled

aluminium finished steel reflectors, made for all angles and distributions, has already led in the field of industrial reflectors; this line has been augmented by a complete line of porcelain enameled steel reflectors, all types, bowl or shallow lines, and at all angles, made to fit all sockets, and also with sockets attached.

Supplementing these splendid lines the Holophane Company Limited, offers the use of its Illuminating Engineering Department, without charge, that their various globes or reflectors may be used with maximum results in illumination. All inquiries regarding any of the above lines should, in the future, be referred to the Holophane Company, Limited, Toronto.

Kellogg Desk Stands

The Kellogg Switchboard & Supply Co. are distributing a card entitled "Many a Truth is Spoken in Jest" which is a take-off on "Humpty Dumpty" to bring out the indestructible qualities of the Kellogg desk stand as follows: "An Old Fashioned Desk Stand sat on the Wall. An Old Fashioned Desk Stand had a bad fall. And all the King's Horses and all the King's Men couldn't put this Old Desk Stand together again." Kellogg desk sets have proved from long experience that, whether they are stood on a wall, a desk or a table, they will give lasting, reliable service. The Kellogg desk stands, with steel reinforced rubber mouth piece and steel reinforced rubber receiver shells, are unbreakable in telephone service. They are efficient, up-to-the-minute telephones for every class of service in all climates and among the handsomest and most symmetrical of any on the market. According to the card a Kellogg desk stand is a real asset to the subscriber, to the exchange to which it is connected, and to the company—because it is a speaking advertisement for better telephones.

A New X-Ray Product

The illustration shown herewith represents a new X-ray reflector intended for drop cord and bench lighting in shops, over counters and work tables, for all kinds of localized lighting, and for general illumination from comparatively low ceilings, as, for instance, bowling alleys, basements, store rooms, and corridors. The National X-Ray Reflector Company claim a very high efficiency and unusual permanency for this reflector. It is constructed of glass in one piece. The vertical and spiral corrugations produce an al-



most perfect diffusion. A coating of elastic enamel protects the silvered reflecting surface from cracking and deterioration. This X-ray reflector meets a demand for a distributing type of reflector for 25-watt and 40-watt Mazda lamps. At thirty per cent. from the vertical, with a 40-watt lamp, No. 555 delivers 9½ apparent candle power. The reflector is 6⅜-in. in diameter and 5½-in. high.

New Engineering Firm in Canada

One more proof of the fact that British engineering firms are awaking to the desirability of Canada as a customer is to be seen in the strong support being given by a number of the larger British manufacturers to a new company which has recently been organized in London, England, under the name of the Canadian British Engineering Company, Limited. A circular recently published by this company states that the firms which they represent in Canada under sole agency agreements have a combined capital of over \$60,000,000, with works and yards covering a ground area of 500 acres and employing in all something over 50,000 work people. Among the list of firms represented are the names of some of the largest manufacturers of engineering appliances in the world who have never before attempted to do business in Canada. Mr. Leonard Andrews, of London, England, is the managing director of the company in England, and Mr. W. A. Martin, late assistant general manager of the Toronto Electric Light Company, is managing director for Canada.

Mr. Henry Coles, E.E., who has had a wide experience in general engineering construction work in England, will have charge of the technical end of the business.

The offices of the company are located at 2 Toronto street, Toronto.

Two-Rate Meters

Fig. 1, shown herewith, illustrates the "Two-rate" meter put on the market by the Chamberlain & Hookham Meter Company, Limited, Toronto. It is supplied for single, two and three-phase circuits with iron or glass cover, and can be fitted with either pointer or cyclometer counter. The principle employed is a double scale counter, high and low rate, the normal position being the low scale. When a small coil is energized via Time Switch, Fig. 2, the gear changes to the high scale. The Time Switch can be set to

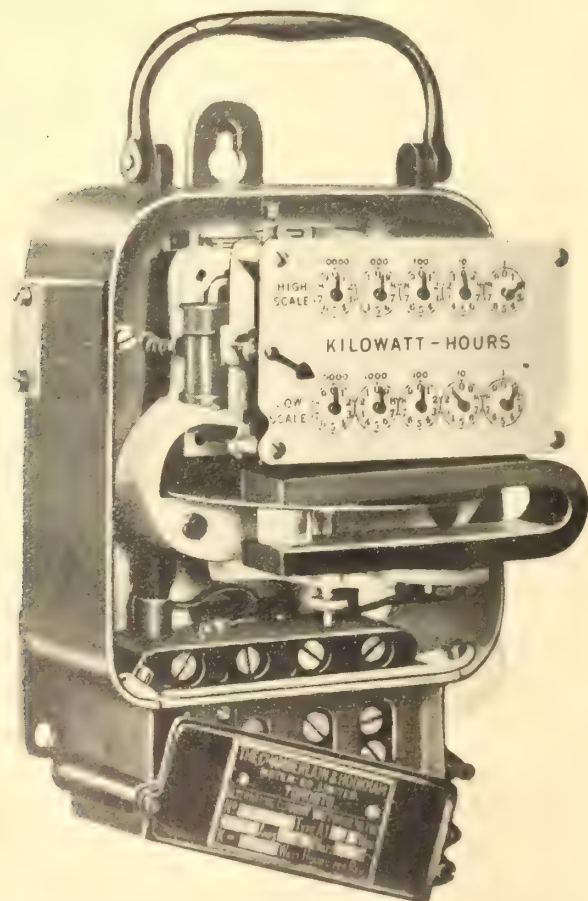


Fig. 1

any hour it is required to switch on and off, by slackening the thumb screw and setting the arms to the desired point. The clock has one very distinct advantage in as much as it

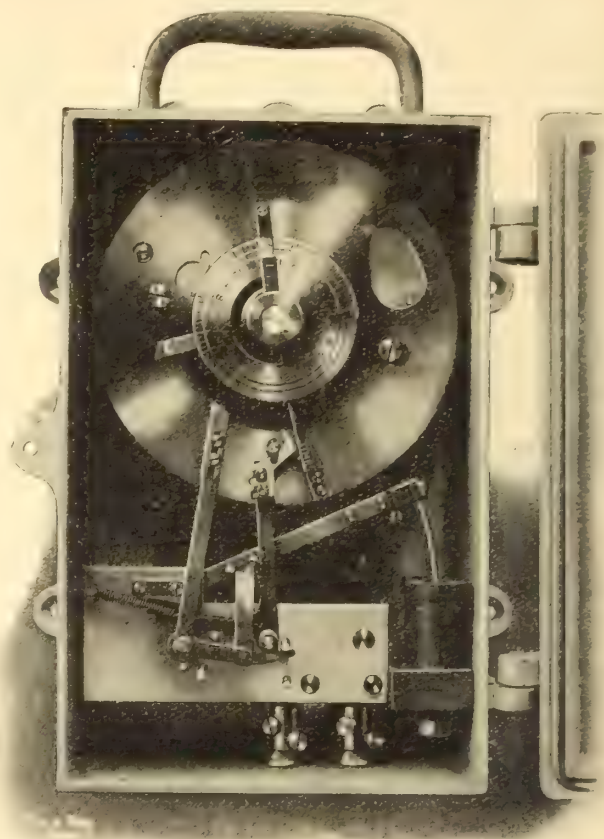


Fig. 2

runs for six weeks with one winding, i.e., when the meter is read each month the clock is wound up.

The whole apparatus has been shown by tests to be quite reliable, and the clock itself is a beautiful piece of mechanism.

Manufacturers' Statistics

The census and statistics office of the Department of Trade and Commerce, Ottawa, has issued a report containing figures of manufacturing records for the year 1910 as compared with the year 1900. The following table gives the principal statistics for the two census years, together with the total increase and the increase per cent. in the decade.

The table of census of the manufactures of Canada for 1910 shows that electrical apparatus and supplies to the value

Schedule	1900	1910	Increase	
			totals	per cent
Establishments..... NO.	14,630	19,209	4,559	31.12
Capital..... \$	446,916,487	1,245,745,496	798,829,009	178.74
Employees..... NO.	339,173	514,281	175,108	51.62
Salaries and wages..... \$	113,249,350	240,523,651	127,274,301	112.36
Products..... \$	481,053,375	1,164,775,532	683,722,157	142.13

of \$15,021,841 was produced by 47 establishments with a combined capital of something over \$17,000,000. The number of employees was 6,345 and the salaries and wages paid amounted to \$3,497,089. The number of electric light and power establishments in 1910 totals 266, with a combined capital of \$111,000,000, employing 6,039 men and turning out products to the value of \$12,917,232.

Small Motors in the Home

The Westinghouse Electric and Manufacturing Company have just issued No. 10 of their "Small Motors," in which they describe the experiences of various persons who have installed small motors in their homes. In one case the motor operates the vacuum cleaner, the dish washer, the clothes washing machine and a small lathe. Another user makes his motor pump the tires of his automobile. In another case it is attached to the sewing machine and the boy of the house uses it besides to operate a jig saw and for driving grinding and buffing wheels. This same customer also dwells at length on the educative value of this kind of toy to the average boy. A fourth customer, in addition to the above uses, also grinds his coffee each morning and can operate an egg beater. Another automobile owner runs a buffing wheel in connection with a flexible shaft to keep his automobile parts polished. The diverse uses of the electric motor in the ordinary household are only beginning to be recognized and only when this recognition becomes universal will the present-day servant problem be solved. An electric motor in the house will work at all hours of the day and do all sorts of jobs without a cross or dissatisfied word or look. Indeed, the pleasant hum of a motor is no small adjunct to its other good qualities.

Vancouver Sales Manager

Mr. J. F. Little, who has been attached to the Toronto office of the Northern Electric & Manufacturing Company, has been appointed sales manager at Vancouver for the same company, and assumed his new duties early in September. A farewell dinner was tendered him at the Engineers' Club by some of his business associates and friends. The chairman, Mr. J. F. Ward, district sales manager of the company, expressed his great regret in losing Mr. Little and predicted a full measure of success for him in the west. Mr. W. M. Roeder, Toronto manager of the Northern Electric, also paid tribute to Mr. Little's many excellent qualities. Mr. C. A. Howe, who officiated as toastmaster, then proposed a toast to the guest of the evening, to which Mr. Little feelingly responded. An opportunity was afforded for impromptu remarks from each one present, which left no doubt as to Mr. Little's popularity and also as to the good feeling and co-operation existing among the staff of the Northern Electric & Manufacturing Company.

Aluminium Prices

The International Aluminium Syndicate has fixed the price of aluminium for next year's delivery at 160 marks per 100 kilos (\$380 per metric ton of 2,204.62 pounds) with the usual increase for special marks. The syndicate, however, will not dispose of the entire output of 1913 at this price, there being a general view among members that production during the next 12 months will not be able to keep pace with consumption, and that still higher prices will be possible. On the other hand the syndicate has all along been very emphatic in asserting their intention of in no way handicapping the development of the aluminium-consuming industries by unduly raising prices. At \$380 per ton manufacturers have quite a good margin of profit, and the price can not be considered at all excessive in view of the present levels of metals generally, and particularly of copper and tin.—Daily Consular and Trade Reports.

C. P. R. Signal System

The C. P. R. are extending their automatic signalling system. The engineering department have under construction new signal work from St. John to Vanceboro, which includes the installing of three automatic signals with switch indicators, and from Fairville to Bay Shore and St. John

to Fairville the company are installing the electric staff system. Similar work is in progress between Brigham Junction and Montreal Junction, Place Viger to St. Therese in the Eastern Division, and in the Ontario Division three equipments with automatic signals, and switch indicators, are being installed, while electric staff systems from Orangeville to Fraxa Junction, Islington to West Mimico and Leaside Junction to Don are being carried out. Similar work is also being pushed ahead with all speed in the Lake Superior division from Romford Junction to Sudbury.

Farming by Electricity

The Canadian Crocker-Wheeler Company, Limited, manufacturers and electrical engineers, with head office and factory at St. Catharines, have issued a little booklet entitled "Farming by Electricity," written by Elbert Hubbard. In his inimitable style Fra Elbertus expatiates on the value of electricity to the farmer, describing at some length the many uses to which it can be put and the unusually satisfactory results obtained where Canadian Crocker-Wheeler motors are used.

To Rid Cities of Smoke by Electricity

Professor W. W. Strong, of the Department of Industrial Research, University of Pittsburgh, has after considerable research, discovered a method of getting rid of Pittsburgh's bad reputation of being the dirtiest and most smoky city in the world. It is confidently predicted that as soon as his method has been duly tested in that place, other cities will follow "soot" and adopt his plans.

It is announced that Mr. Wm. L. Laib, well known in engineering and machinery circles and for many years manager of the Hanna Engineering Works, has joined the forces of the Reynolds Electric Flasher Manufacturing Company, in the capacity of secretary and treasurer. An extensive expansion move is under way by this company and various lines such as transformers, time-switches, colored lamp hoods, and sockets, as well as a complete line of sign supplies, in addition to their already large line of flashers, are being added.

Mr. Jas. Kent, manager C. P. R. Telegraphs, is reported to have stated that by the end of the present year every section of their 4000 miles of track will be equipped with telephone despatching apparatus, which has been found quicker in operation, more adaptable to emergencies and to require less skilled operators. This system also carries the advantage that trains may communicate with stations from any intervening point using apparatus with which all trains are now being equipped.

Folder 4230 issued by the Westinghouse Electric & Manufacturing Company entitled "How Westinghouse Small Motors Can Help You" is an attractive little publication describing, with illustrations, some of the manifold uses to which small electric motors can be put. The views show actual installations in the home and shop, of small motors. The publication is intended for dealers and central stations, space being left for their name on the back.

The Chamberlain & Hookham Meter Company, Limited, Toronto, have recently received contracts for the supply of meters to Regina and Canora.

1070. Car pit electric plant.—A Lancashire firm manufacturing car pit electric plant for dealing with electric tram-cars, etc., and also engineering tools, wishes to arrange for their sale in Canada.

Current News and Notes

Ayr, Ont.

The Ayr Electric Light and Power Co. has made an offer to the municipality to sell out for \$3,500. The matter will likely be submitted to the rate-payers. In the event of the by-law being carried, it is stated that the town would likely move the plant back to Nithvale and operate it by water power.

Barrie, Ont.

At a recent meeting of the Flos council, held at Elmvale, a by-law was passed authorizing the erection and operation of a municipal telephone system.

Berlin, Ont.

Four industrial establishments in this city have requested Berlin's Light Commission to submit an estimate on 4,560 horse power of electric energy. One of these establishments contemplates using 2,280 horse power. In the event of such a contract being closed, it would be necessary to greatly increase the transforming capacity at this point as the present capacity is only 1,500 horse power.

Bathurst, N.B.

The Bathurst Electric Light & Water Power Co., J. P. Leger, president and manager, is pushing forward the construction of a large concrete dam at Tetagouche Falls. Electric power will be generated there and transmitted to Bathurst, serving the farming community along the line as well.

Brandon, Man.

Tenders are called to September 27th for two return tubular boilers and stokers.

Canora, Sask.

The ratepayers, by a vote of 68 to 1, favored the expenditure of \$20,000 on an electric light system. The Northwestern Electric Co., of Regina were awarded the contract.

Clinton, Ont.

The Town Council, it is reported, D. L. MacPherson, Clerk, will purchase two 30 h.p. motors and other electrical equipment.

Coronation, Alta.

A by-law will be submitted to the ratepayers authorizing expenditure of \$45,000 for the installation of an electric light plant and waterworks system.

Calgary, Alta.

The Calgary Municipal Railway recently made a record by carrying 71,000 people in one day and collecting a revenue of \$3,073.50.

The Calgary Power Company contemplate enlarging their hydro-electric plant on the Bow River, also building a new plant one mile farther up the river.

Dorval, Que.

An electric light plant will be installed under supervision of V. H. Dupont, 62 St. James street, Montreal.

Duncans, B.C.

By-law re extension of power plant and waterworks at cost of \$100,000,

passed. Engineers are Dutcher, Maxwell Co., Vancouver. Tenders called shortly.

Elmira, Ont.

This community is anxious to secure Niagara power. It would be necessary to build a transmission line from Waterloo, about ten miles distant.

Edmonton, Alta.

Early in September, the city of Edmonton took over the operation of the south side, or Strathcona, telephone system, which has been operated in the past by the government.

A by-law will be submitted providing for the issue of debentures to the amount of \$21,900 for the purchase of a telephone sub-station.

Fort Frances, Ont.

At a recent sitting of the International Waterways Commission held at International Falls, the fact was shown that the Minnesota and Ontario Power Company retarded the flow of water from Rainy Lake into Rainy River in July of last year with the result that navigation was materially interfered with.

Fredericton, B.C.

An electric stamping machine is being installed at the Fredericton post office, which will have a capacity of approximately 25,000 letters per hour.

Fort William, Ont.

Owing to difficulties in operation and the cost of the necessary extensions and maintenance, Acting Mayor O'Donnell, of Fort William, recently expressed himself as being strongly in favor of disposing of the electric light and telephone business. This would also open the way for the giving of a franchise to a private company for the manufacture and delivery of gas which the municipality, under present conditions, does not care to do, as this would introduce a competitor for light and power business.

Galt, Ont.

A gas electric car supplied by the Preston Car & Coach Co. has been placed on the line of the Galt, Preston and Hespeler Railway Co.

Humboldt, Sask.

By-law passed to install an electric lighting plant to cost \$30,000. Chipman & Power, Mail Bldg., Toronto, Ont. are engineers.

Hagersville, Ont.

This village carried a by-law to enter into an agreement with the Hydro-electric Power Commission.

Hamilton, Ont.

It is reported that New York capitalists will construct an electric railway at the expense of \$1,000,000, along the brow of the Mountain.

The International Harvester Company, Sherman ave., are reported as now ready to install machinery and power equipment.

Harriston, Ont.

By-law is being submitted asking authorization to expend \$10,000 in the installation of an electric light system.

Kamloops, B.C.

By-laws providing for a hydro-electric plant and distribution system were carried almost unanimously.

Kingston, Ont.

An electric gondola owned by Commodore F. G. Bonne, of New York, is the first of its type to appear on the St. Lawrence. The gondola is 40 feet in length and is operated by an electric motor, driven by storage batteries. 7½ to 9 miles per hour is the speed of this boat.

London, Ont.

It is reported the London Free Press Printing Company will operate its plant by electricity and will require wiring, asbestos, piping and general equipment.

The present agreement with the Bell Telephone Co. for an exclusive franchise expires Jan. 1st, 1913. No steps are being taken to renew the franchise as the Bell people believe the chance of opposition is very small.

Lethbridge, Alta.

Six cars are now operating on the new line, which number will be increased as soon as the necessary power can be installed.

Moose Jaw, Sask.

Tenders will be received by Clerk E. B. Bonnell for installation of a Gamewell fire alarm system.

Montreal, Que.

It is reported that a company in which Mr. Shirley Ogilvie and Mr. F. H. Anson are interested, will develop the Iroquois Falls and use the power for pulp manufacture. At and near this point there is said to be 50,000 horse power available.

Ottawa, Ont.

The municipal system, which is managed by a commission consisting of two members will have a surplus even larger than last year's, \$27,000. This is in the face of a cut in rates amounting to about \$20,000.

The price which Messrs. Harty & O'Connor place on their property at Chats Falls is said to be \$3,000,000. This property was recently expropriated for government use and it is stated the amount of compensation will be fixed by the Ontario Railway and Municipal Board.

As a result of personal inspection of the route of the Hudson Bay Railway, Hon. Frank Cochrane is reported as stating that this road will very likely be ultimately operated by electricity and White Mud Falls is mentioned as the most likely source of hydro-electric power.

Penticton, B.C.

Tenders are called for construction of a concrete power house in connection with the Hydro-electric plant to be installed by the municipality.

Port Arthur, Ont.

The new electric fire alarm system has just been completed in this city and given a successful try-out. The cost of

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SIEMENS BROS. DYNAMO WORKS

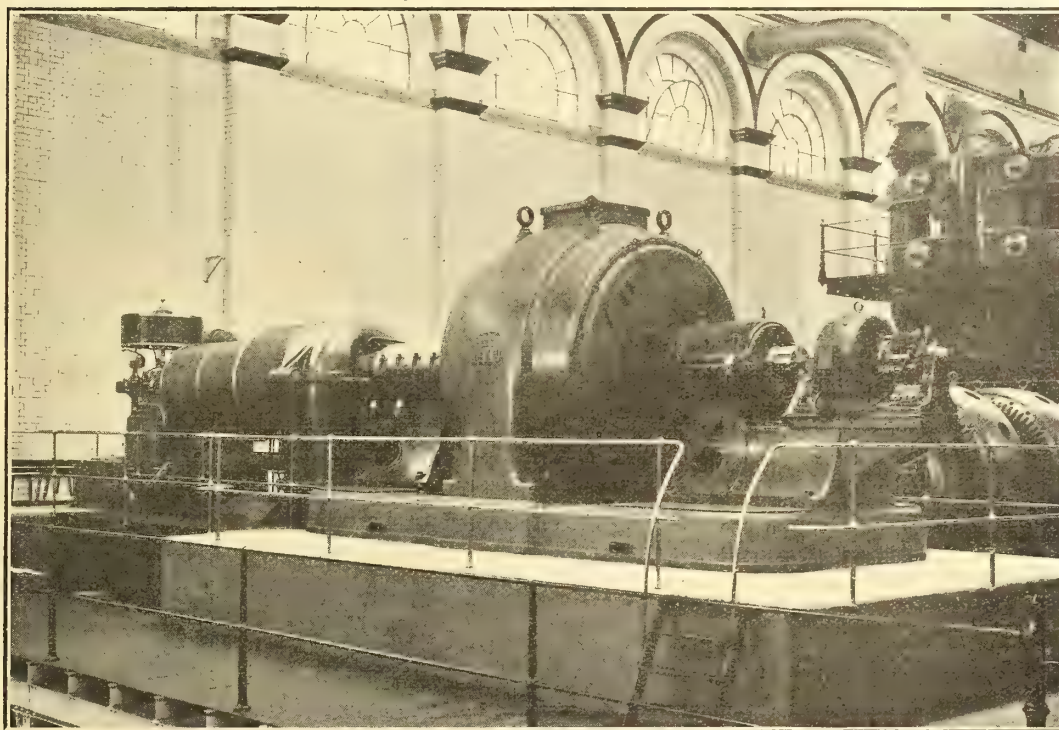
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Siemens 2,000 K. W. 6,600 Volt Turbo Generator

We have supplied or on order for Canada the following Turbo Generators :

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|---|--|
| 1—2500 K. W. for Dominion Coal Co. | 1—1500 K. W. for City of Lethbridge. |
| 1—2000 K. W. for City of Edmonton. | 1—750 K. W. for Nova Scotia Steel & Coal Co. |
| 3—2000 K. W. for Dawson City | 2—750 K. W. for City of Medicine Hat. |
| 1—1500 K. W. for City of Regina. | 2—500 K. W. for Nova Scotia Steel & Coal Co. |
| 1—500 K. W. for Wayagamack Pulp and Paper Co. | |

We undertake the complete electrical equipment of Central Stations of every description, and Transformer Stations up to and including 110,000 volts.

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London, England

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Head Office for Canada

10 Adelaide Street East, TORONTO

Branch Office: 707 McArthur Building, WINNIPEG

the system is reported as something over \$12,000.

By-law was voted on, Sept. 16th, re extension of street railway line eastward to Hedge Siding.

On September 16th by-laws were passed to expend \$34,000 on street railway improvements and \$82,000 on belt line construction.

Saskatoon, Sask.

Between 800 and 900 miles of long distance telephone line are now under construction by the government of Saskatchewan.

Regina, Sask.

Council are considering several extensions to civic lighting system.

The government has let the contract for the installation of a complete new automatic system of telephones. The equipment will be supplied by the Automatic Electric Co., of Chicago, and will be similar to that recently installed in Saskatoon, a description of which appears in the September issue of the Electrical News.

Superintendent Doughty states that it is proposed to institute at least a ten-minute service on every line, which will give about a two-minute service on Eleventh Ave., the business street of the city.

River Glade, N.B.

The Jordan Sanitarium Commission are preparing plans for a power house for Sanitarium and for furnishing lights for distance of four miles to station.

Rapid City, Man.

Meetings are being held to interest the ratepayers in the installation of an electric light plant in this town. At a recent meeting Mr. Cadle, managing director of the British Canadian Engineering & Supply Co., explained the scheme which is calculated to cost from \$15,000 to \$17,000. The annual maintenance is placed at \$5,000.

Stratford, Ont.

The Stratford Railway Co. have filed plans for the construction of 6.85 miles of street railway in this city.

Salmon Arm, B.C.

Tenders have been received by the engineers, Dutcher Maxwell & Co., for oil engine generator, transformers, transmission poles, cross arms, etc., for power plant.

St. John, N.B.

Town Council is contemplating the installation of an incinerator.

Sherbrooke, Que.

The Municipal Council of Bromptonville are considering the scheme of having the Sherbrooke R. & P. Co. extend their lines to Bromptonville, six miles distant.

Sussex, N.B.

Council will install auxiliary steam plant in connection with the town water system. Engineer in charge, J. W. Mills.

Saltcoats, Sask.

Plans are prepared for a telephone exchange of one storey, brick vincer construction.

Sydney, N.S.

The Cape Breton Electric Co. has voluntarily increased the wages of their

street railway employees to the following: 20c per hour, 1st year; 21c, 2nd year; 22c, 3rd year; 24c, 4th year and after.

Toronto, Ont.

Mr. A. H. Johnston, of the London & Southwestern Railway Co., London, Eng., recently visited Toronto to investigate the Prentice system of wireless control. This system was described in a recent issue of the Electrical News.

The St. Clair Ave. street railway line, which is being constructed by the municipality, is practically completed from Bathurst street west to the terminus. The work of grading east from Bathurst is more difficult, but is now proceeding satisfactorily, and, it is said, will be completed in a few weeks.

Tenders are called by the architects, Darling & Pearson, for complete lighting fixtures for new C. P. R. building, Toronto.

Three Rivers, Que.

Three Rivers Tramway Co. will construct $5\frac{1}{2}$ miles of street railway system. Complete equipment will be required.

Thornbury, Ont.

A by-law authorizing the raising of money for electric power extensions carried.

Victoria, B.C.

The passenger traffic on the local lines of the B. C. E. R. Co. was larger during August than during any previous month, the monthly returns showing the number of people carried as 978,289. This compares with 773,958 one year ago.

Wilkie, Sask.

By-law passed re extension of waterworks and electric lighting system.

Weyburn, Sask.

Tenders have been received by B. C. McNab, Deputy Minister of the Telephone Department of Saskatchewan, for the erection of a telephone building in this place.

Welland, Ont.

Mr. Laughlin, of the Niagara, Welland & Lake Erie Railway Co., states that work of extension on a line to the suburb of Dane City and to Rosedale, will be completed this fall.

Winnipeg, Man.

Tenders were received by the Board of Control up to Sept. 25 for three 200 kw. transformers for light and power department.

The Gould Engineering Company have received contract to supply 100 ornamental standards.

The Northern Electric & Mfg. Co., agents for Imperial Wire & Cable Company, Montreal, received contracts for 100,000 feet of cable at 11.44 cents per ft.

By-law carried Sept. 13th authorizing additional expenditure of \$750,000 on municipal distribution plant.

A charter has been applied for to construct an electric line from Winnipeg to Portage la Prairie and from there to Delta on Lake Manitoba.

It is said the survey is almost completed by the Winnipeg & Lake Winnipeg Railway for a ten-mile branch line from near Middleton on the present line to Stony Mountain. Grading to be done

this winter, steel to be laid in the spring. Will probably continue from Stony Mountain to Stonewall next year.

Recent contracts for weatherproof wire have been awarded by the city to the Eugene Phillips Co., The Imperial Wire & Cable Co., The Canada Wire & Cable Co., and The Standard Underground Cable Company.

Yorkton, Sask.

The town of Yorkton, Sask., is finding it necessary to add to its electrical equipment. This town already has a Diesel oil system in operation and has found it so satisfactory that they are now asking tenders for an additional 500 horse power capacity engine to be direct coupled to an alternator and exciter. Switchboard equipment with auxiliary panel and series tungsten street lighting apparatus will also be purchased.

Moonlight Schedule for October, 1912

Courtesy of the National Carbon Company, Cleveland, Ohio.

Date.	Light.	Date.	Extinguish.	No. of Hours
Oct. 1	6 10	Oct. 1	10 00	3 50
2	6 10	2	10 50	4 40
3	6 10	3	0 00	5 50
4	6 10	4	1 10	7 00
5	6 10	5	2 30	8 20
6	6 00	6	3 50	9 50
7	6 00	7	5 00	11 00
8	6 00	8	5 20	11 20
9	6 00	9	5 20	11 20
10	6 00	10	5 20	11 20
11	6 00	11	5 20	11 20
12	5 50	12	5 20	11 30
13	5 50	13	5 20	11 30
14	5 50	14	5 30	11 40
15	5 50	15	5 30	11 40
16	5 50	16	5 30	11 40
17	5 50	17	5 30	11 40
18	10 00	18	5 30	7 30
19	11 00	19	5 30	6 30
20	0 00	20	5 30	5 30
21	1 10	21	5 30	4 20
22	2 10	22	5 30	3 20
23	3 10	23	5 40	2 30
24	No Light	24	No Light	
25	No Light	25	No Light	
26	No Light	26	No Light	
27	No Light	27	No Light	
28	5 30	28	8 00	2 30
29	5 30	29	8 50	3 20
30	5 30	30	9 50	4 20
31	5 30	31	11 00	5 30

Total.....210 50



New WESTON INSTRUMENTS

A Full Line of Alternating Current Switchboard Indicating Instruments

is offered by this Company, comprising:

**WATTMETERS, Single and Polyphase.
POWER FACTOR METERS.
SYNCHROSCOPES.**

**FREQUENCY METERS.
VOLTMETERS.
AMMETERS.**

and New Models of Weston D.C. Instruments to match

This whole group of instruments embodies the results of several years exhaustive study and scientific investigation of all the complex electrical and mechanical problems involved in the development of durable, reliable, sensitive and accurate instruments for use on alternating current circuits.

Every detail of each of these instruments has been most carefully studied and worked out so as to be sure that each shall fully meet the most exacting requirements of the service for which it is intended. Neither pains nor expense has been spared in the effort to produce instruments having the longest possible life, the best possible scale characteristics, combined with great accuracy under the most violent load fluctuations and also under the many other trying conditions met with in practical work. Every part of each instrument is made strictly to gauge and the design and workmanship and finish is of the highest order of excellence.

We invite the most critical examination of every detail of each member of the group. We also solicit the fullest investigation of the many other novel features and very valuable operative characteristics of these new instruments and request a careful comparison in all these respects with any other make of instrument intended for like service. We offer them as a valuable and permanent contribution to the art of electrical measurement. Their performance in service, will be found to justify the claim that no other makes of instruments approach them in fitness for the service required from A.C. Switchboard indicating instruments.

Full particulars of design, construction, prices etc., are given in Catalogue E. N. 16. Write for it.

WESTON ELECTRICAL INSTRUMENT CO.

Main Office and Works, Newark, N. J.

New York, 114 Liberty St.
Chicago, 1504 Monadnock Block.
Boston, 176 Federal St.
Philadelphia, 342 Mint Arcade.
Birmingham, Brown Marx Bldg.
Detroit, 44 Buhl Block.

St. Louis, 915 Olive St.
Denver, 231-15th St.
San Francisco, 682 Mission St.
New Haven, 29 College St.
Cleveland, 1522 Prospect Ave.

Paris, 12 Rue St. Georges.
Berlin, Genest St. 5 Schoenberg.
London, Audrey House, Ely Pl.,
Holborn

Toronto, 76 Bay Street.
Montreal
Winnipeg
Vancouver
Calgary } The Northern
Electric &
Manufacturing
Company

HEAD OFFICE:
PRESCOT, ENGLAND

Paid up Capital \$8,500,000.00

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British Insulated and Helsby Cables Limited

POWER CABLES

For Working Pressures up to

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Sole Canadian Representatives:

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Cablegrams "Insulator" Montreal
Telephone Main 1521, Montreal

Power Building, Montreal

Condensed Department

RATE

Positions Wanted 1 2 cents a word per insertion.
Positions Vacant 1 2 cents a word per insertion.
Miscellaneous. 1 2 cents.

Tender advertisements, equipment for sale, etc., 15 cents per agate line (14 agate lines make one inch) per insertion.

Advertisers who wish to conceal their identity may do so by using an Electrical News box number without extra charge.

Forms close on the 18th of each month.

Situations Vacant

Wanted: Electrical Salesman preferably having good connection with trade. All answers in strict confidence. Good salary to really first-class man. State fully experience, etc., to Engineering Equipment & Supply Co., 410 St. James street, Montreal, P.Q. 10

Sales Engineer

Sales Engineer: Large Electric Manufacturing Company wishes to employ two young men in the Machinery Sales Department, college training and shop experience required, selling experience not necessary, but such experience will be given extra consideration. Apply Box 570, Electrical News, Toronto, Ont. 10-11

Situations Wanted

Position wanted in charge of small plant. Excellent references. Fifteen years' experience. Reply to E. Scott Rivett, 17 Brunswick Street, Montreal, Que. 10

Position wanted by Electrician, as power house operator, used to A.C. and D.C. currents. Four and a half years' experience. Age 22; single. Reply to Box 588, Electrical News, Toronto, Ont. 11

Position as manager or superintendent of small plant. Hydro for preference, or where power is supplied in bulk. Excellent references. Ten years' experience. Box 503, Electrical News, Toronto, Ont. 10

Office manager for electrical manufacturing concern in Toronto wanted. Good salary and prospects to the right party. States experience, age and salary expected. Correspondence will be received in strictest confidence. Box 592 Electrical News, Toronto, Ont. 10

Graduate desires position with consulting or contracting engineer, in Montreal preferred. Has two years shop practice with best electrical manufacturing companies. Has also experience in surveying. Reply Box 562, Electrical News, Toronto, Ont. 10

Position Wanted—As Manager, Superintendent or Salesman with Electrical or Mechanical concern, operation or construction. Fifteen years' experience, all systems and voltages. Specialized on power soliciting and cost detail. Best of testimonials; strictly temperate. Wish permanency; married. Reply Box 563, Electrical News, Toronto, Ont. 10

Agents Wanted

One of the largest firms in the Eastern States manufacturing switchboards, panel boards, knife switches, etc., wants representatives in Eastern Canada. For particulars write to C. L. Morton, c/o Electrical News, 643 Old South Building, Boston, Mass. 10

Agents Wanted

Large United States firm, manufacturing pneumatic cleaners, would like to hear from firms who would represent them in Canada. The cleaner is of new improved design and has been sold extensively throughout the United States. A first class proposition will be offered to responsible firm. Reply Box 583, Electrical News, Toronto, Ont. 10-11

Business Opportunities

To Manufacturers

Large United States firm, manufacturing pneumatic cleaners, wants to get in touch with manufacturer in Canada who will assemble their cleaners in 500 lots. Reply Box 586, Electrical News, Toronto, Ont. 10-11

Car Ventilating Systems

The Vacuum Car Ventilating Company has commenced manufacturing Mechanical Car Ventilating Systems under Canadian Patent No. 128070, dated September 13, 1910, and is prepared to furnish same on demand. For detailed information and prices, address Lock Box No. 25, Windsor, Ont. 10-t.f.

Patents For Sale

The proprietors of Letters Patent No. 127080 relating to "Process of Manufacturing Iron Electrodes for Use in Alkaline Accumulators," and No. 127081 relating to "Active Masses for Positive Electrodes of Electric Elements, etc.," desire to dispose of the Patents or to grant Licenses to interested parties at reasonable terms with a view to the adequate working of the Patents in Canada.

Inquiries to be addressed to the actual proprietors, Svenska Ackumulator Aktiebolaget Lungner, Stockholm, Sweden.

Tenders for Electrical Plant

Scaled tenders addressed to T. F. Atcheson, Secretary-Treasurer, and marked "Tenders for Electrical Plant," will be received until 12 noon, October 31st, 1912, for the following:—

One 500 B.H. Diesel Engine, direct coupled to alternator and exciter.

One Switchboard with auxiliary panel and series tungsten street lighting apparatus.

Specifications to be obtained on application to the office of the Town Electrical Engineer.

A certified cheque for five per cent. of the amount of the tender must accompany each tender.

The lowest tender will not necessarily be accepted and the right is reserved to reject any or all tenders.

M. M. INGLIS, Electrical Engineer,
10 Yorkton, Sask.

Machinery For Sale at Friday Prices

1—5 kw., 110 Volt Compound C. G. E. Type B Generator.

1—7½ kw., 110 Volt Compound Westinghouse Type S. Generator.

1—110 kw., 550 Volt D.C. C. G. E. Compound Belt Driven Generator.

15—500 Volt D.C. Motors, 1 to 15 h.p.

4—½ H.P. Century and Wagner S. P. 125 Cycle Motors.

1—200 kw. 125 Cycle, 2 Phase, S. K. C. Generator, 2,300 Volt, just like new, with or without Tandem Wheelock Engine and Condenser.

The above apparatus is guaranteed just as good as new. Price about one-half their original value.

Apply,

MACKENZIE ELECTRIC CO.,
10 Sarnia, Ont.

Judicial Sale of Assets by THE DOMINION TELEPHONE MANUFACTURING COMPANY, Ltd. Waterford, Ont.

In the matter of the Winding Up Act, Revised Statutes of Canada, Chap. 144 and Amending Acts,

and
In the matter of The Dominion Telephone Manufacturing Company, Limited, of Waterford, Ont.

Scaled tenders will be received, addressed to George Kappel, Official Referee, Home Life Building, Toronto, and marked "Tender in the matter of the Dominion Telephone Manufacturing Company, Limited," up to twelve o'clock noon of Thursday, the 3rd day of October, 1912, for the purchase 'en bloc' of the following assets of the Dominion Telephone Manufacturing Company, Limited, of Waterford.

Parcel No. 1.

Real Estate—Being in the Village of Waterford, in the County of Norfolk, Ontario, and known as Lots 1, 2, 3 in Block 24, Plan No. 1913, also half interest in 11 feet 11 inches of north part of Lot 5 in Block 24 to be used as an alley, with a frontage of 300 feet by 130 feet deep, more or less, together with two-storey brick factory, electric building, frame store house, valued at ... \$19,800.00

Plant—Consisting of machinery, tools, shafting, hangers, pulleys and battery, office furniture and factory fittings, also electrical plant in full running order; valued at ... \$26,271.55

Parcel No. 2.

Merchandise—Consisting of telephones, completed; telephones in course of construction, telephone posts, cabinets completed, supplies, raw materials, valued at ... \$18,120.00

Tenders will be received for the two parcels 'en bloc' and tenderers so tendering are required to state the amount apportioned by them to each parcel. Tenders will also be received for the two parcels separately, and in case the whole property can be sold more satisfactorily in parcels, such tenders may be accepted.

Said land, buildings and plant are subject to certain mortgages, as follows:—

1.—Mortgage on real estate and plant for \$8,500, and interest.

2.—Mortgage on real estate, plant and merchandise for \$17,282, and interest.

Tenders must be for the unencumbered value of the property. The Liquidator at his option may require the purchaser to assume all or any of the above encumbrances, in which case credit will be given upon the purchase money accordingly. All rent, taxes, insurance, water rates and similar items will be adjusted to the completion of sale. There are no encumbrances known to the Liquidator other than those above set forth.

Tenders must accept property as it stands.

Terms of payment will be ten per cent. of the amount of tender on acceptance of tender and the remainder of such tender within thirty days without interest, secured to the satisfaction of the Liquidator.

Tenders will be opened at the office of George Kappel, Official Referee, Home Life Building, Toronto, on Friday, the 4th day of October, 1912, at three o'clock p.m., when all tenderers should be present. All tenders must be accompanied by a marked cheque payable to the Liquidator for five per cent. of the amount of the whole tender, which will be returned if the tender is not accepted, and forfeited if the tender is accepted and not completed by the purchaser.

The highest or any other tender not necessarily accepted.

As to Parcel No. 1, the purchaser shall search the title at his own expense, and the Liquidator shall not be required to furnish any abstracts or to purchase any deeds, declaration or other evidence of title except those in his possession. The purchaser shall have ten days in which to make any objections, or requisitions, in respect of the title, and in case the purchaser shall, within such time, make any objection or requisition which the Vendor shall from any cause be unable or unwilling to remove or answer, the Liquidator may then rescind the sale, in which case the purchaser shall be entitled only to a return of the deposit money without interest, costs or compensation.

The other conditions will be the standing conditions of sale of the High Court so far as applicable.

Further particulars as to the properties, inventories, incumbrances, leases, etc., may be had on application to the Liquidator or his Solicitor.

Dated at Toronto, the 6th day of September, 1912.

G. T. CLARKSON, Liquidator.

33 Scott Street.
Kerr, Davidson, Paterson & McFarland,
His Solicitors,
23 Adelaide St. East., Toronto



BRUSH

P R O D U C T S

Autumn Bargains

We are remodelling our present building as we require more space, and are, therefore, compelled to quickly reduce our present stocks.

We are offering at practically cost price forty barrels of Gilbert Shades for Tungsten Lamps, assorted sizes—acknowledged by all to be the best glassware shade on the market.

We also are offering ten Brush Induction Motors suitable for 550 volt, 3 phase, 60 cycle circuits, varying from five to 20 h.p. at exceptionally low prices. These Motors are all guaranteed by the Brush Electrical Engineering Company.

Write us promptly if you are interested

Stuart, Drinkwater & Hingston

485 St. James St., MONTREAL

Limited



Wire Drawn Tungsten Lamps

Immediate delivery. American shapes. An awfully good lamp. Send for a trial lot, at case lot price.

Carbon Lamps

The same lamp we have always handled. We couldn't improve on the quality if we tried. The price is also right.

Other Agencies

Hotpoint Electric Irons, etc., Rollinson Bell Ringers, Transformers and Rectifiers, Cutter Flush Switches Plates and Receptacles, "Brookduct" (Circular Loom), Prismatic Shades. Switch Boxes, Fuses, etc.

Ed. Greene & Co.
Limited

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145 Church Street, Toronto, Ont.

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TYPE "C"



Glass Case—Top Connections

Simplicity of construction.
Perfect accuracy.
Cyclometer or clock dials.
Top or bottom connections.
Prompt deliveries.

Every meter carefully inspected before shipment. Absolutely guaranteed.

Send us your probable meter requirements and let us make you a proposition.

Large stock and fully equipped repair and erection Shops at



Steel Case—Top or Bottom Connections

WEST TORONTO and WINNIPEG

G. C. ROYCE

-

Canadian Manager

Water Wheels

for

Hydro-Electric Power

There are some features of the Samson wheel which make it exceptionally well suited for use with electric generators.

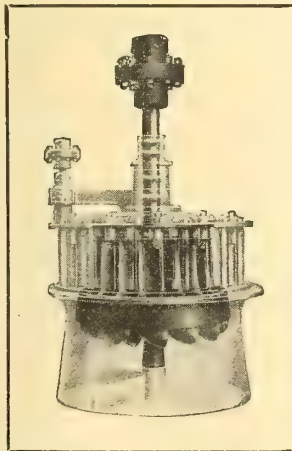
Its high speed for instance. This makes it possible to direct connect it to a fast running generator, and you know that, within limits, the high speed generator is cheaper than the slow speed machine. Direct connection saves also the cost of gears or belts and makes a much more satisfactory installation.

As the high speed is combined in the same runner with great power, **it is always possible to maintain the speed without sacrificing the reserve power**, which is almost indispensable in installations of this kind.

The Samson is also easily controlled by hand or by a governor, thus permitting easily of close regulation, which is a most important factor in hydro electric plants.

The Samson is the wheel that marks the "limit of obtainable efficiency."

You will be interested in our catalogue. Shall we send it?



William Hamilton Company

PETERBOROUGH, ONT.

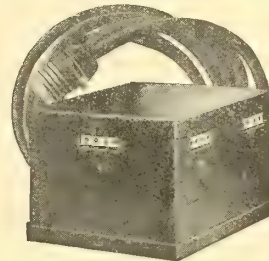
THORDARSON Bell Ringing Transformer

"Junior" Type

For ordinary residence work. Uses house current. More effective than batteries and meter cannot register slight current used. Rings bells up to 3". Small, indestructible; \$3.00. Types "A" and "B" for heavier work, \$4.00 and \$5.00 respectively. *Alternating current only.*



Toy Transformers Power Plants in Miniature



Veritable power plants in miniature. Attach to lamp socket. Operate bells, buzzers, toys, Ruhmkorff and other inductive coils. \$5.00, \$7.00, \$8.00 and \$10.00, according to voltage output. *Alternating current only.*

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At All Electrical Jobbers

Thordarson Electric Mfg. Co.
503 S. Jefferson St., Chicago, Ill., U.S.A.

One of the
Unbeatable
Advantages
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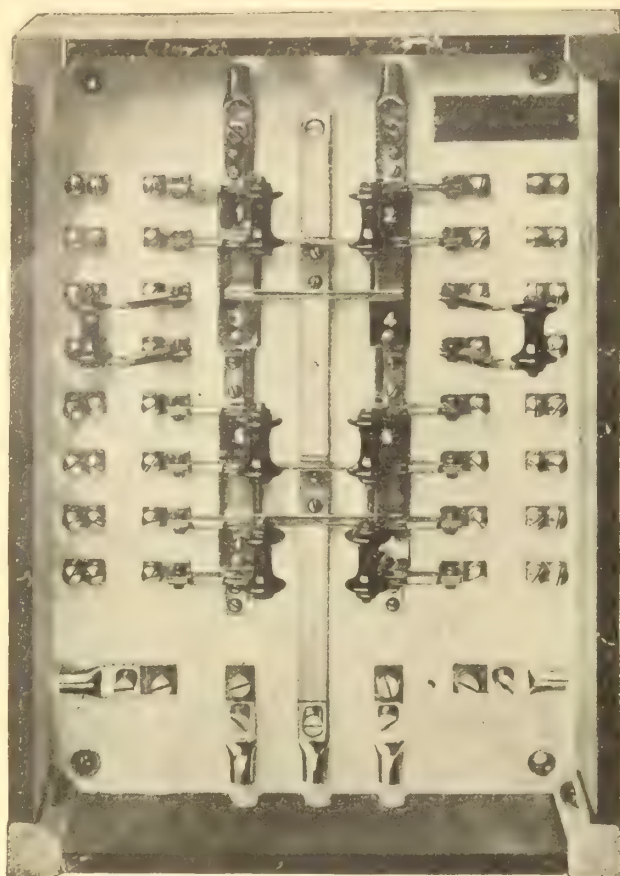
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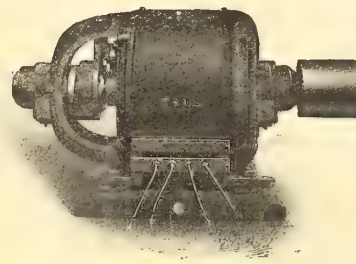
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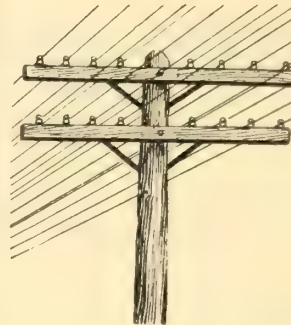
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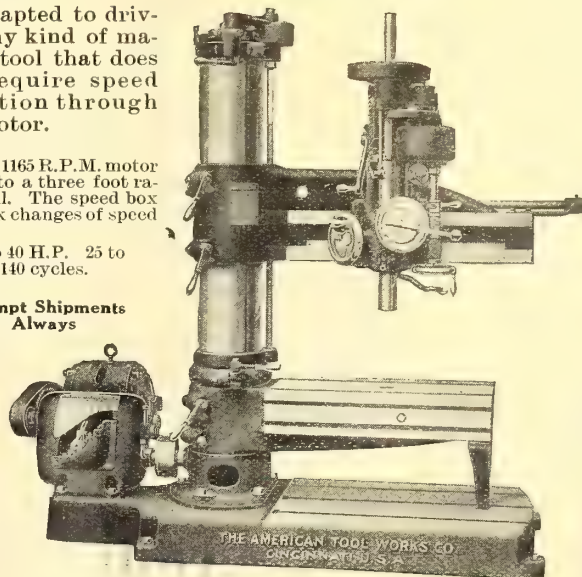
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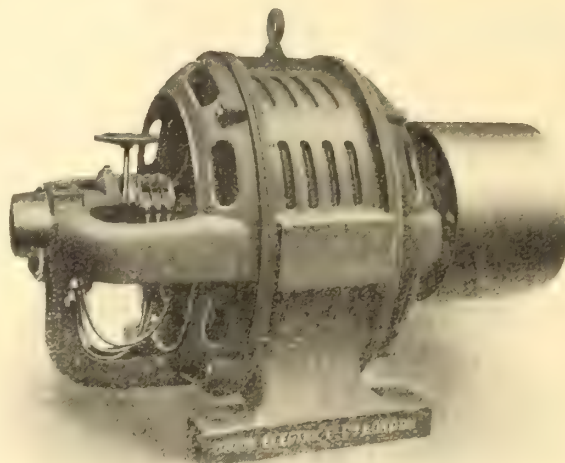
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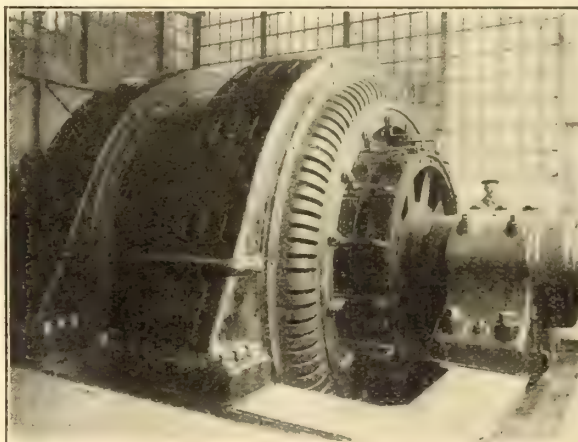
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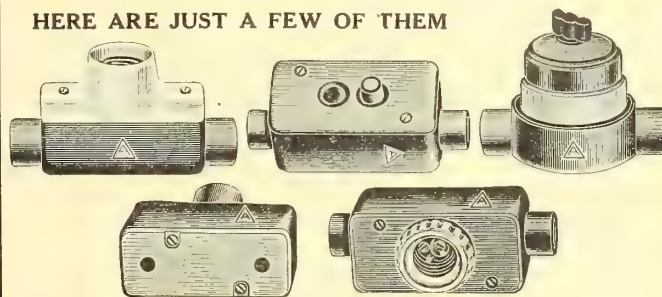
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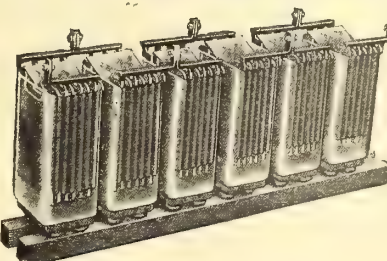
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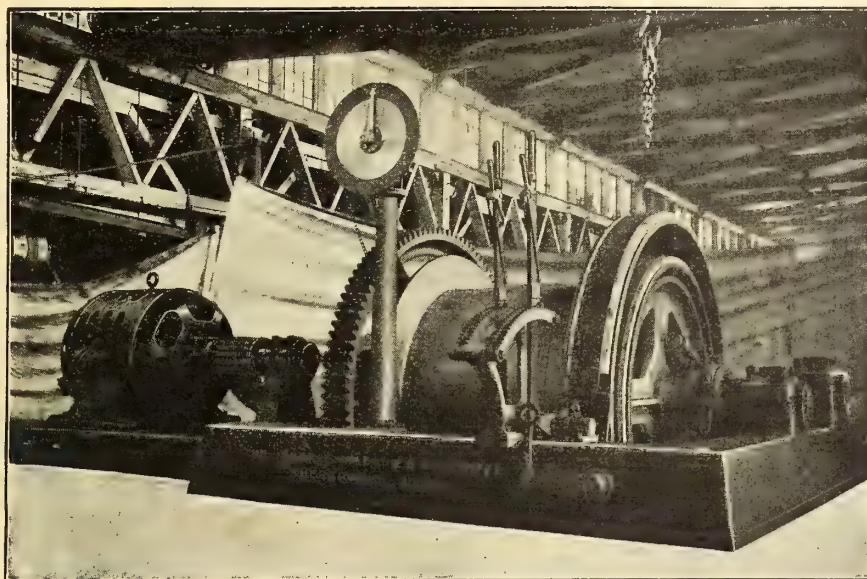
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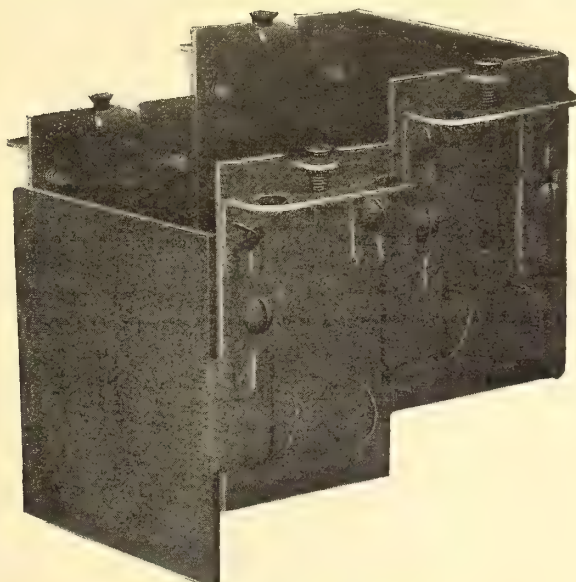
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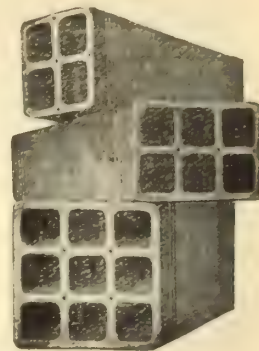
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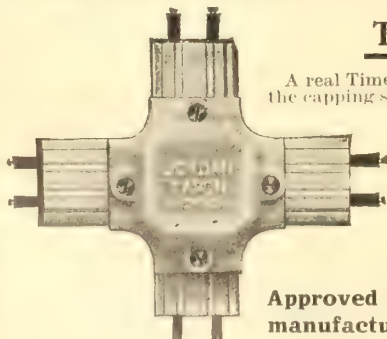
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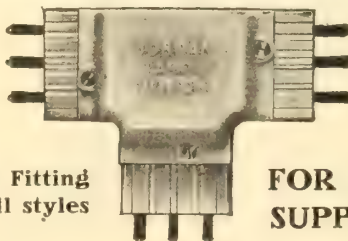
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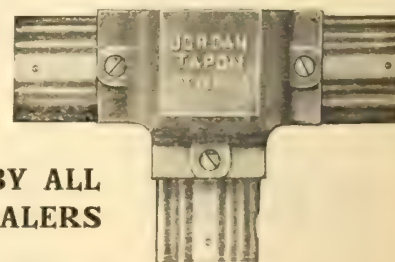
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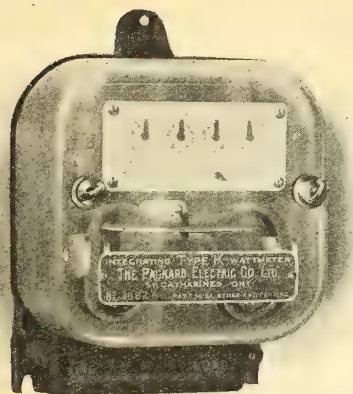


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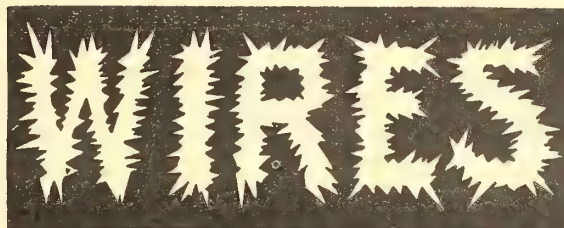
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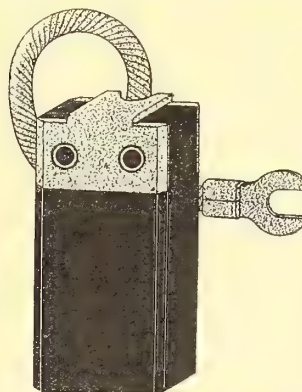
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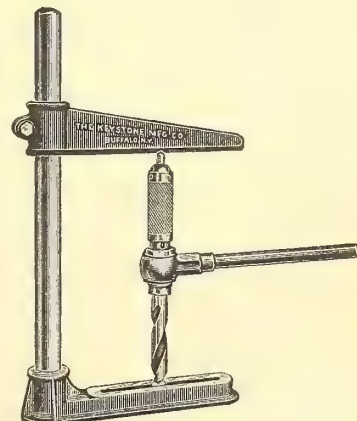
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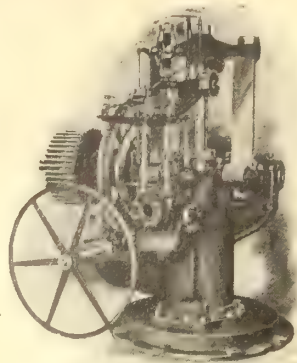
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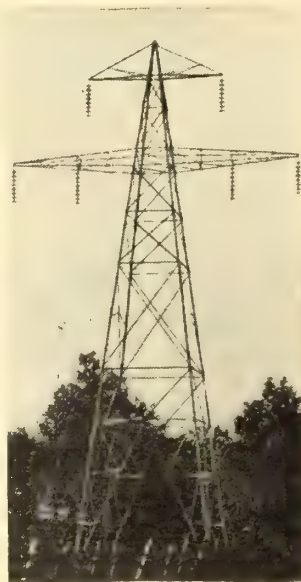
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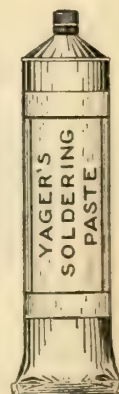
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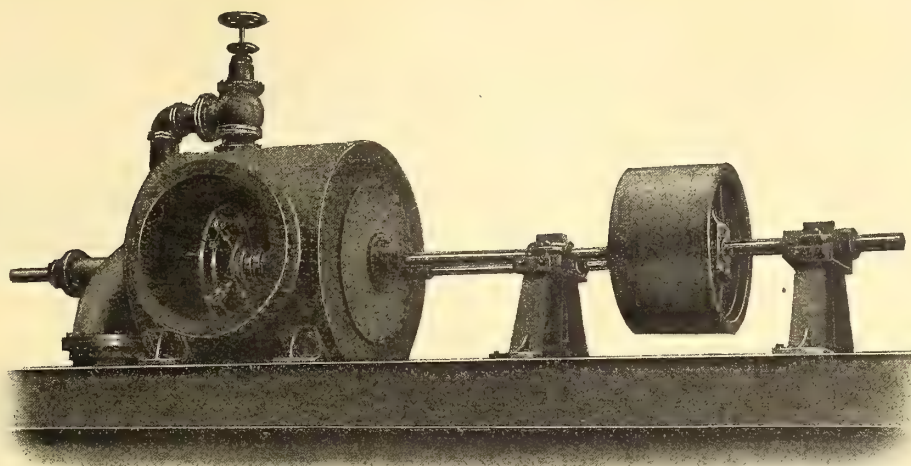
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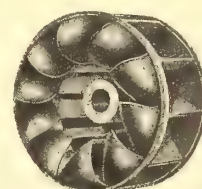
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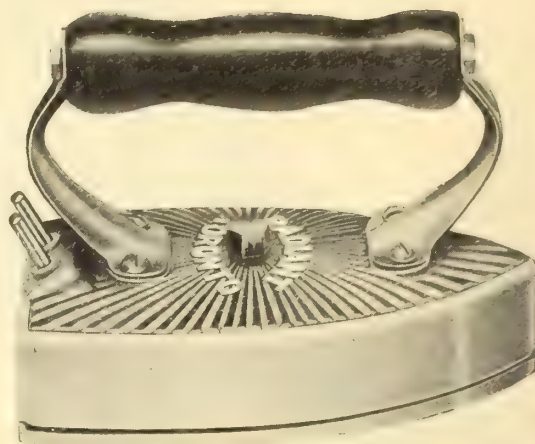
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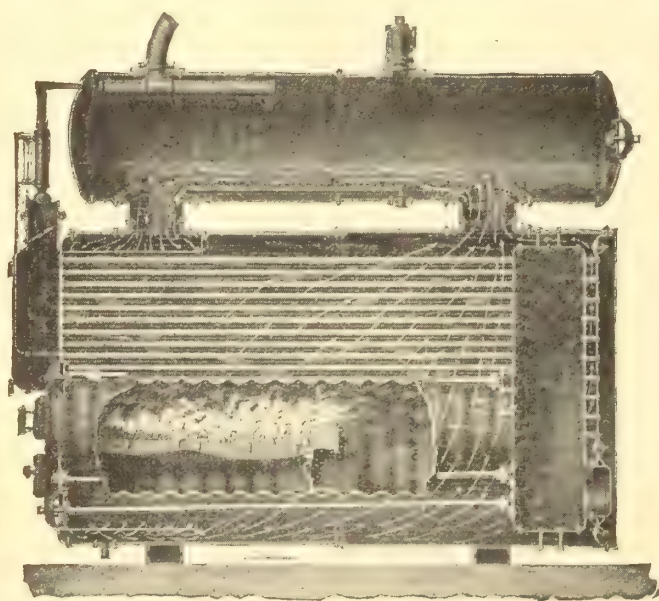


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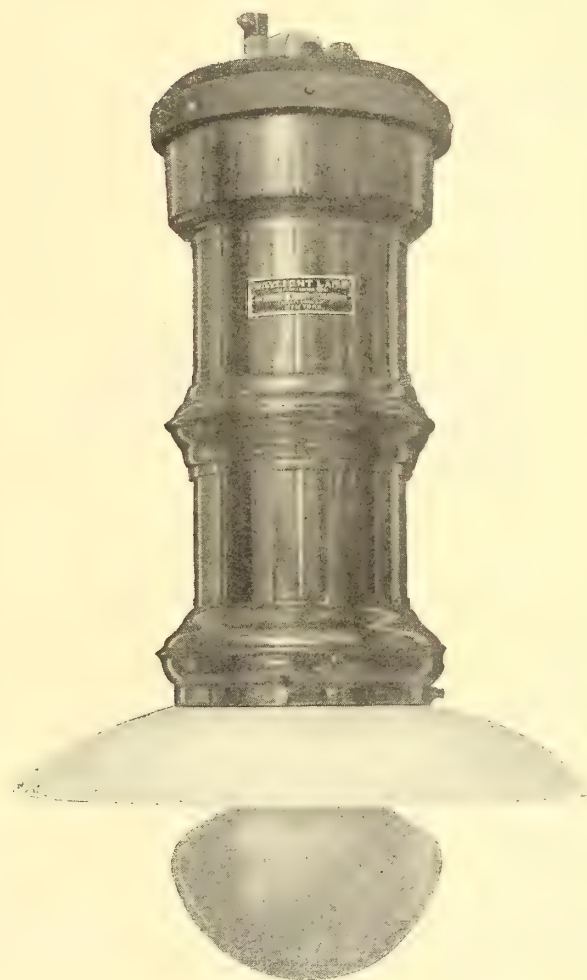
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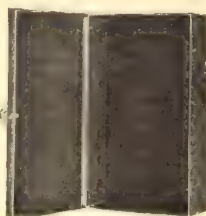
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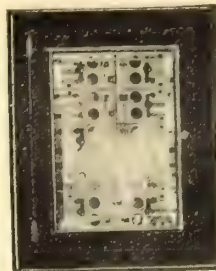
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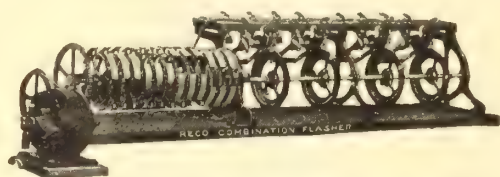
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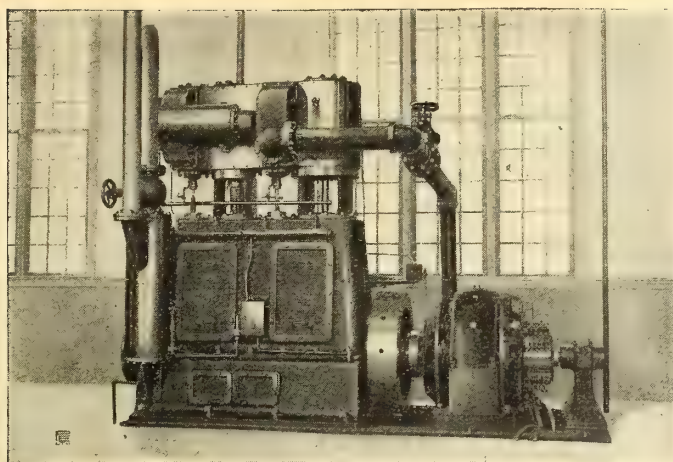
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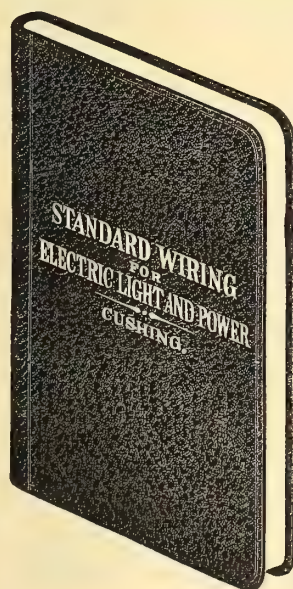
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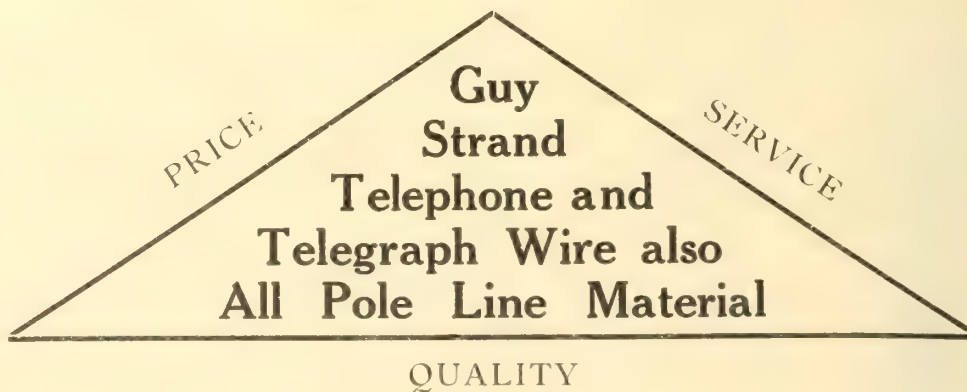
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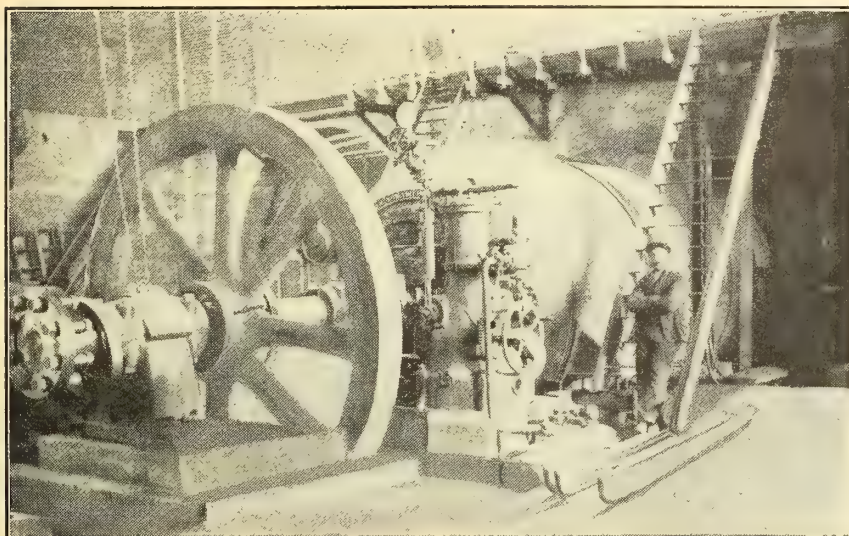
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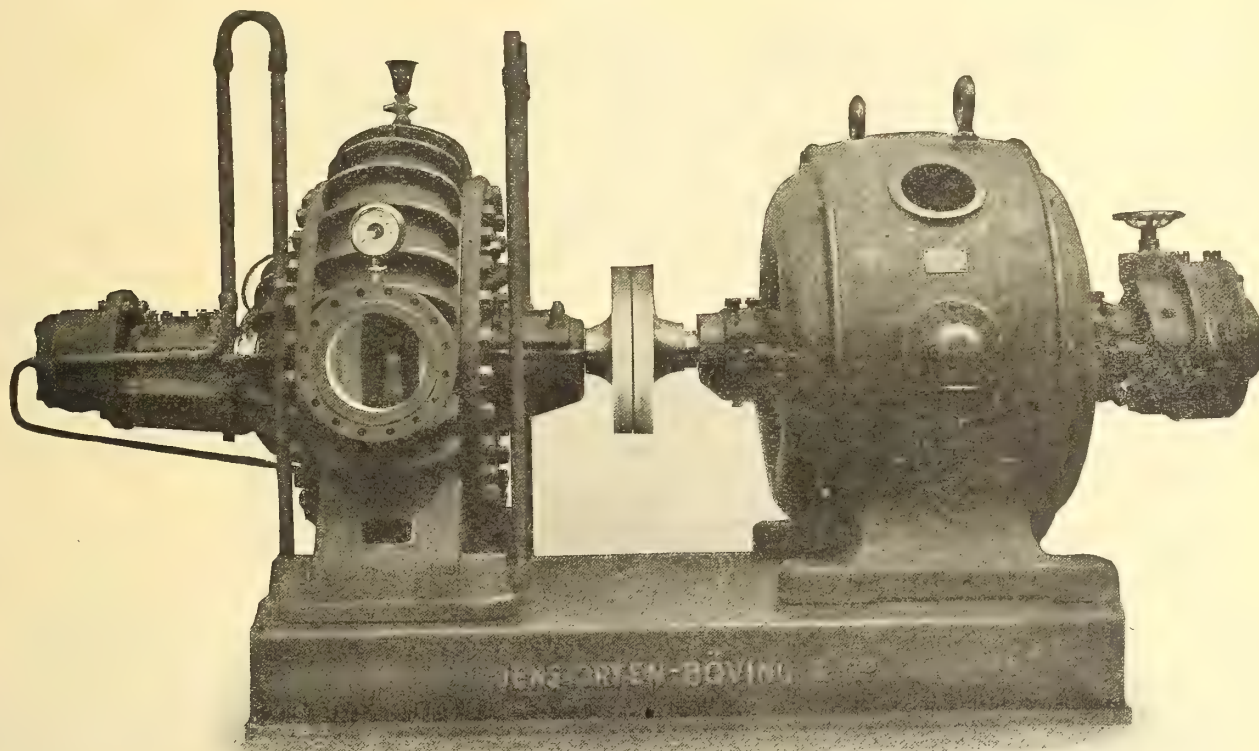
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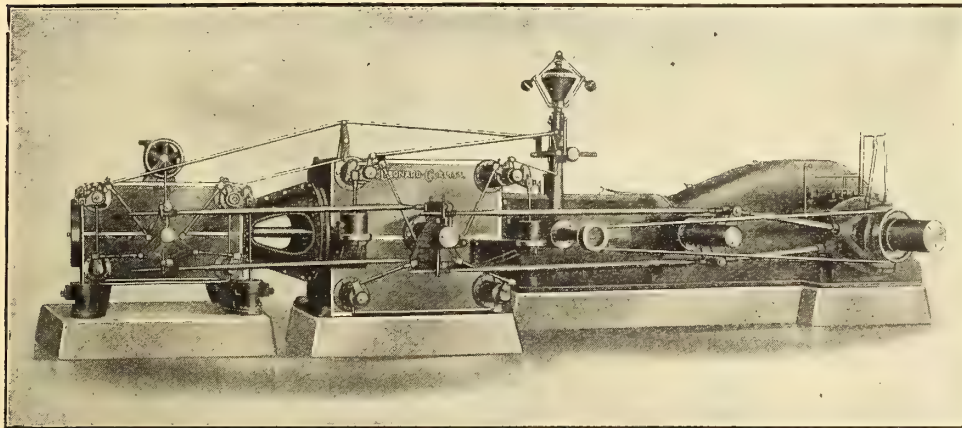
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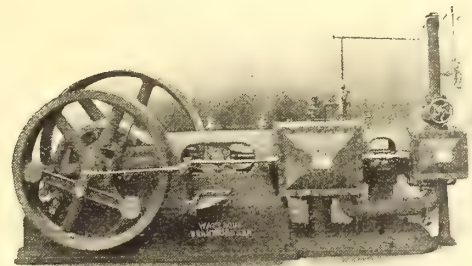
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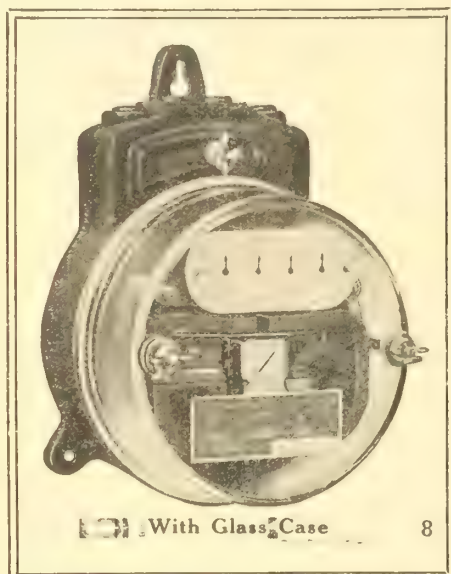
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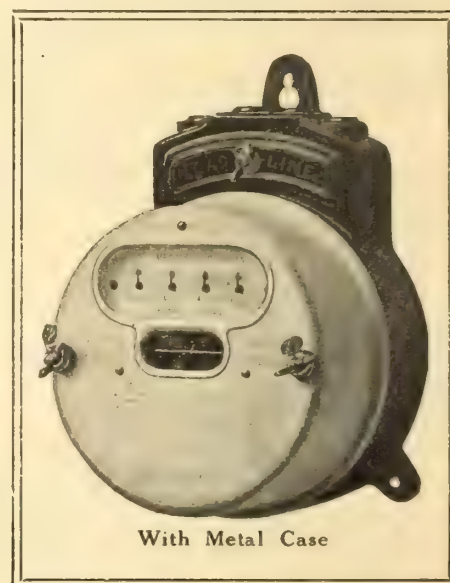
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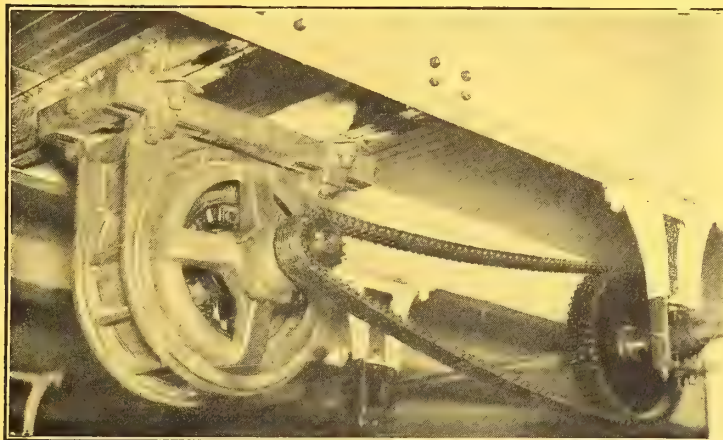
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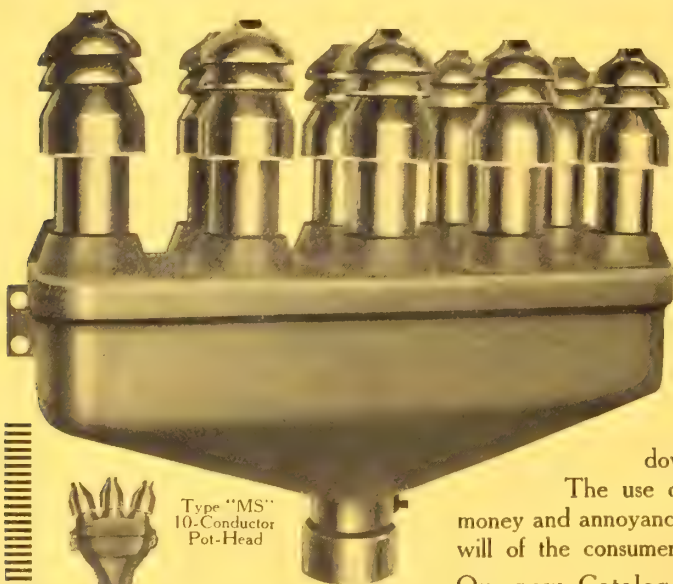
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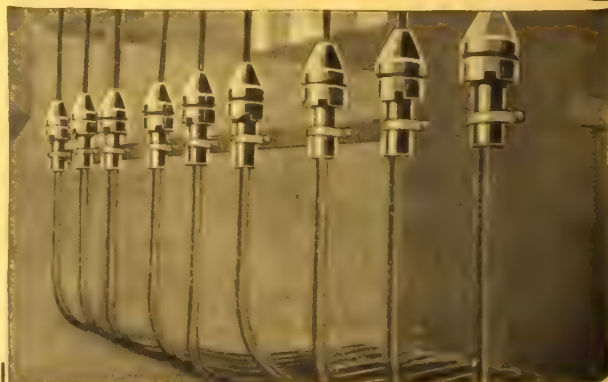
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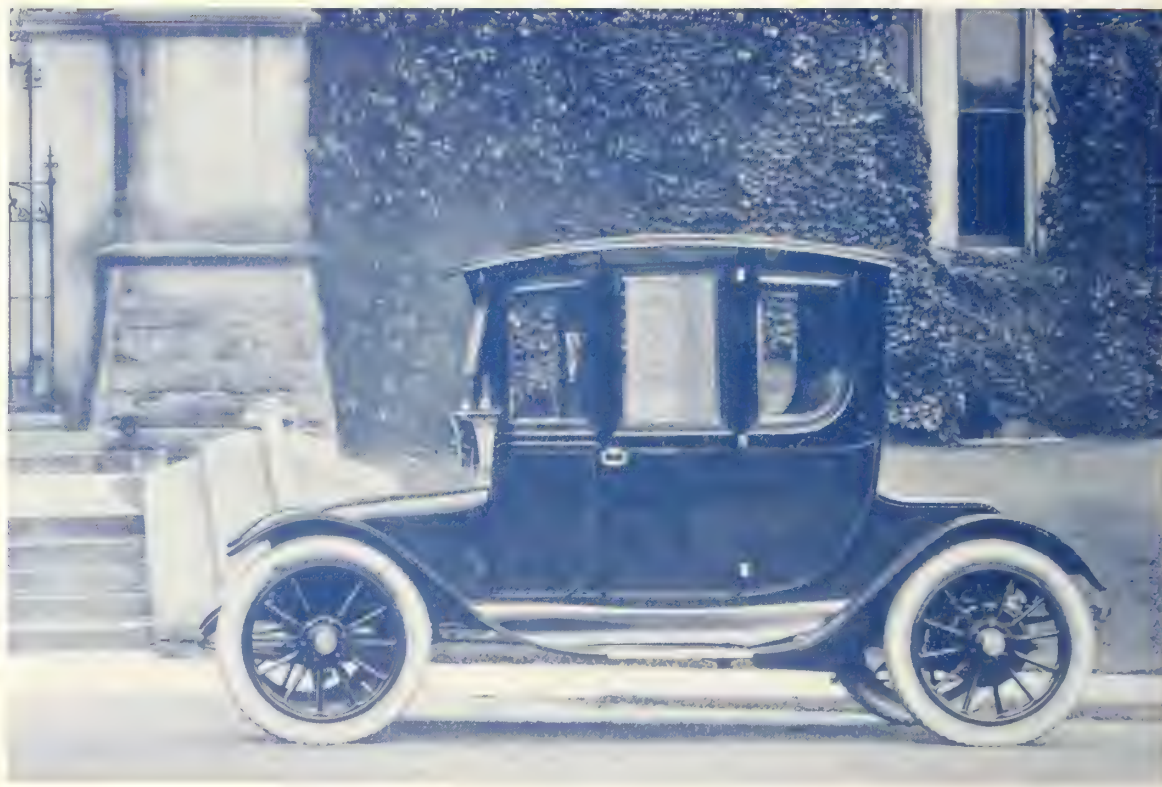
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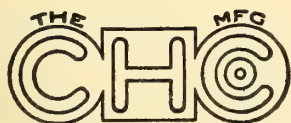
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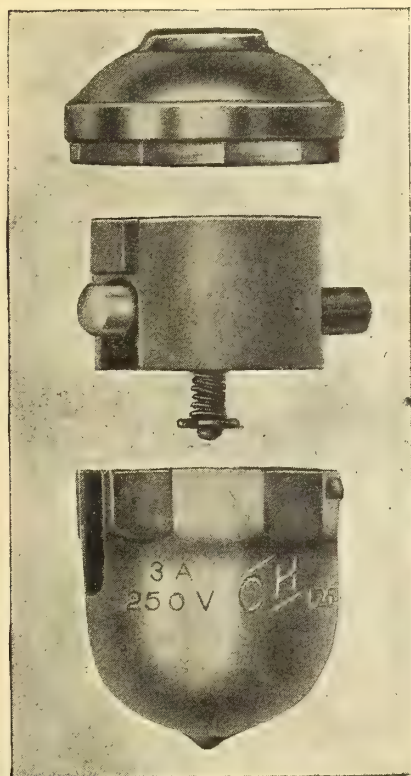
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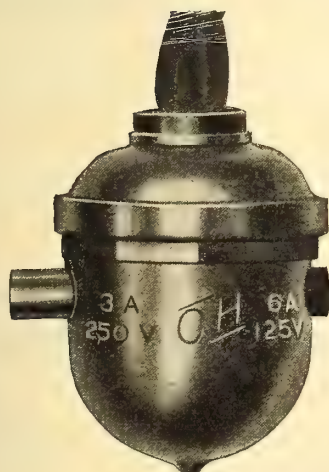
Takes re-inforced cord

6 amps. 125 volts. 3 amps. 250 volts.

7007 Your next order **7007**

If you haven't seen it write for free sample and be convinced

Carried in stock by all jobbers



Actual Size

Manufactured by

Benjamin Electric Mfg. Co.

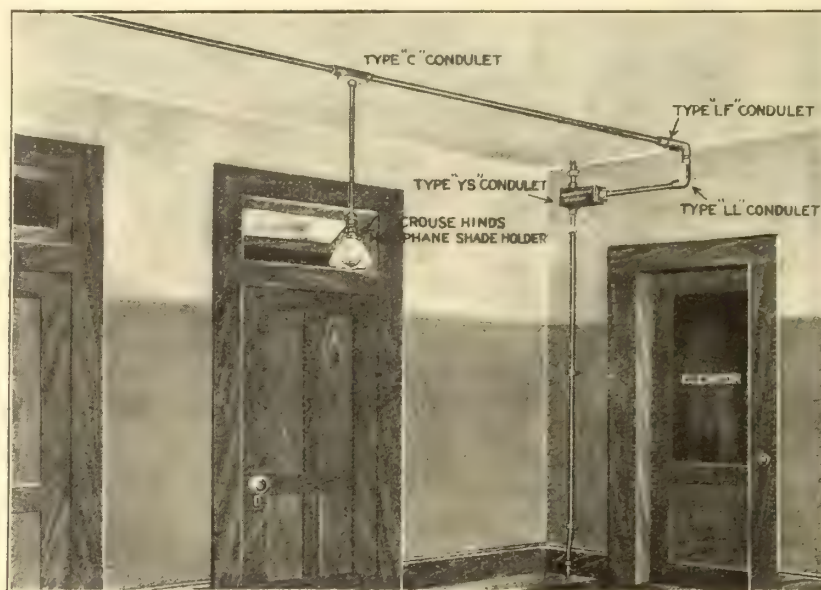
of Canada, Limited

11 to 17 Charlotte St., Toronto

For Plug or Cartridge Fuse Out-Outs

Condulets—"Y" Series

Embody all requirements and recommendations of National Board of Fire Underwriters. Body and threaded hubs are specially designed one-piece iron casting. Cover is of No. 10 gauge sheet steel, securely hinged at back, and closes snugly over rabbet on edge of casting. Spring catch, operated by knob on top of cover, holds latter tightly shut. A universal plate for cut-outs and all necessary screws, but not cut-out, are furnished with each Condulet. Cut-out plate is mounted on pillars a half-inch above floor of Condulet, thus allowing free passage of wires not connected with cut-out. "Y" series of Condulets includes types and sizes for 2 and 3 wire main line, 2 to 2 and 3 to 3 wire single branch and 2 to 2, 3 to 2 and 3 to 3 wire double branch cut-outs



Type "YS" Condulet Installed in Hallway



Type "YD"—for Double Branch Cut-Out, Dead End



Type "YS"—for Single Branch Cut-Out, Through Feed



Type "YC"—for Main Line Cut-Out, Through Feed



Type "YZ"—for Double Branch Cut-Out, Through Feed

Order From Your Dealer. If He Does Not Stock Them, Write Us

WRITE FOR CONDULET CATALOG, BULLETIN NO. 100—SENT FREE TO ANY ADDRESS

Crouse-Hinds Company of Canada, Limited



Main Office and Works:

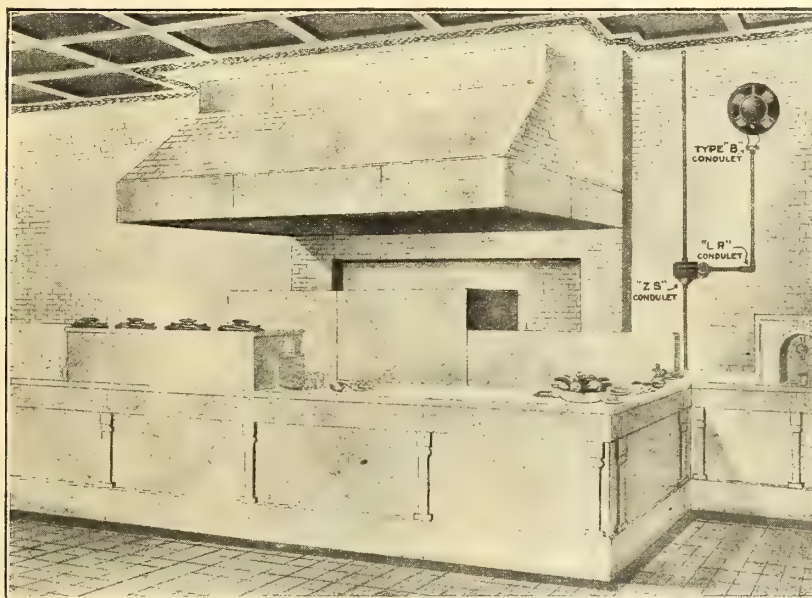
Toronto, Ont., Canada



For Cut-Outs and Snap Switches

Condulets—"Z" Series

Provide for 5, 10 or 20 ampere switches in addition to plug or cartridge fuse cut-outs. Take place of separate cut-out boxes for switches and fuses, besides being stronger, easier to install and more sightly. Have all good qualities of "Y" series shown on opposite page, including structural advantages, plus accommodation for switches. Full complement of adjustable swivels for 5, 10 and 20 ampere switches and universal plate for cut-outs, but neither switches nor cut-outs, furnished with each Condulet. "Z" series includes types and sizes for 2 and 3 wire main line, 2 to 2 and 3 to 3 wire single branch and 2 to 2, 3 to 2 and 3 to 3 wire double branch cut-outs. Main line and single branch cut-outs are each arranged for single switch; double branch cut-outs, for two switches



Type "ZS" Condulet Installed in Lunch Room



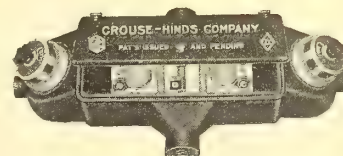
Type "ZD"—for Double Branch Cut-Out, Dead End, Switch on Each Branch



Type "ZS"—for Single Branch Cut-Out, Through Feed, Switch on Branch



Type "ZC"—for Main Line Cut-Out, Through Feed, Single Switch



Type "ZX"—for Double Branch Cut-Out, Through Feed, Switch on Each Branch

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Crouse-Hinds Company of Canada, Limited



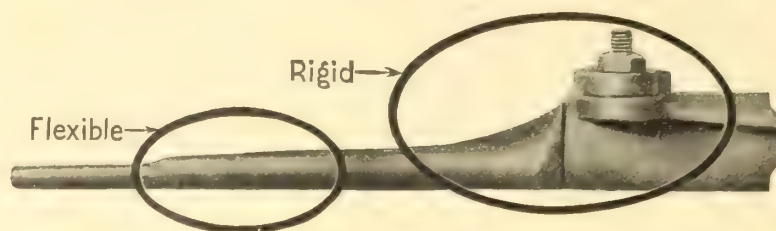
Main Office and Works:

Toronto, Ont., Canada



Westinghouse Line Material

Overhead Devices with Flexible Approaches

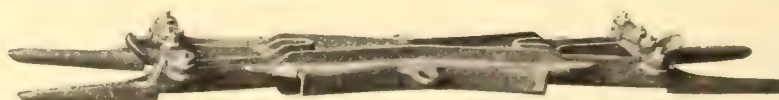
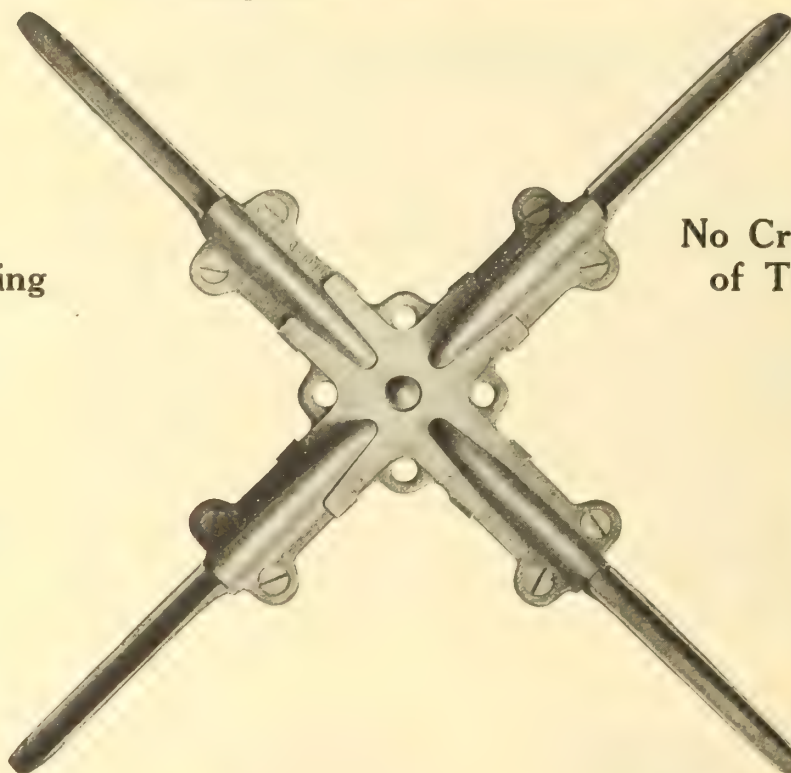


Smooth
Underrunning

No Crystallization
of Trolley Wire

Pounding
Eliminated

Easily
Renewed



*Westinghouse Detroit Frogs, Crossings,
and Section Insulators can now be
had with this valuable feature*

Canadian Westinghouse Co., Limited, Hamilton, Ontario

Toronto Montreal Ottawa Halifax Winnipeg Calgary Vancouver
Traders Bank Bldg. 52 Victoria Square Ahearn & Soper, Ltd. Telephone Bldg. 158 Portage Ave. E. 311 8th Ave. W. Bank of Ottawa Bldg.

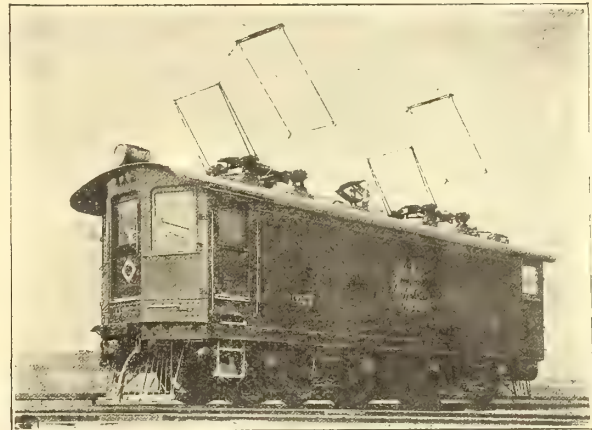
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The largest trunk-line electric roads use Westinghouse Electric Locomotives.

The largest steam road terminal and main line electrifications use Westinghouse Electric Locomotives.

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The St. Clair Tunnel Co.
Pennsylvania R. R.
New York, N. H. & H. R. R.
Long Island R. R.
Boston & Maine R. R.
Erie Railroad
Southern Pacific R.

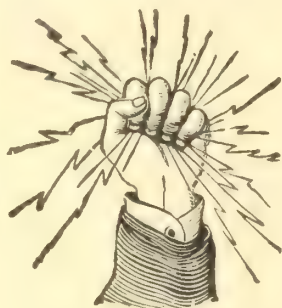


Westinghouse Electric Locomotives are built for operation on Direct Current, Single Phase or Three Phase Systems. Our nearest office will give full particulars

Canadian Westinghouse Co., Limited, Hamilton, Ontario

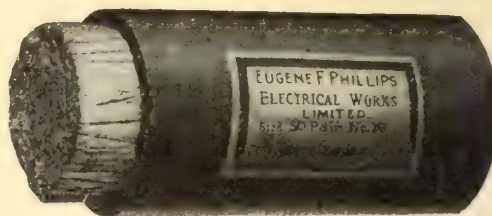
Toronto Traders Bank Bldg. **Montreal** 52 Victoria Square **Ottawa** Ahearn & Soper, Ltd. **Halifax** Telephone Bldg. **Winnipeg** 158 Portage Ave., E. **Calgary** 311 8th Ave., W. **Vancouver** Bank of Ottawa Bldg.

PHILLIPS



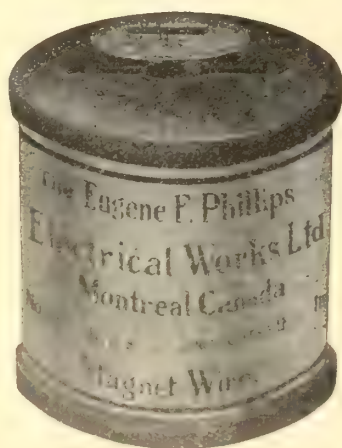
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For Telephone, Telegraph, Lighting,
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Weatherproof Magnet
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Wires and Cables



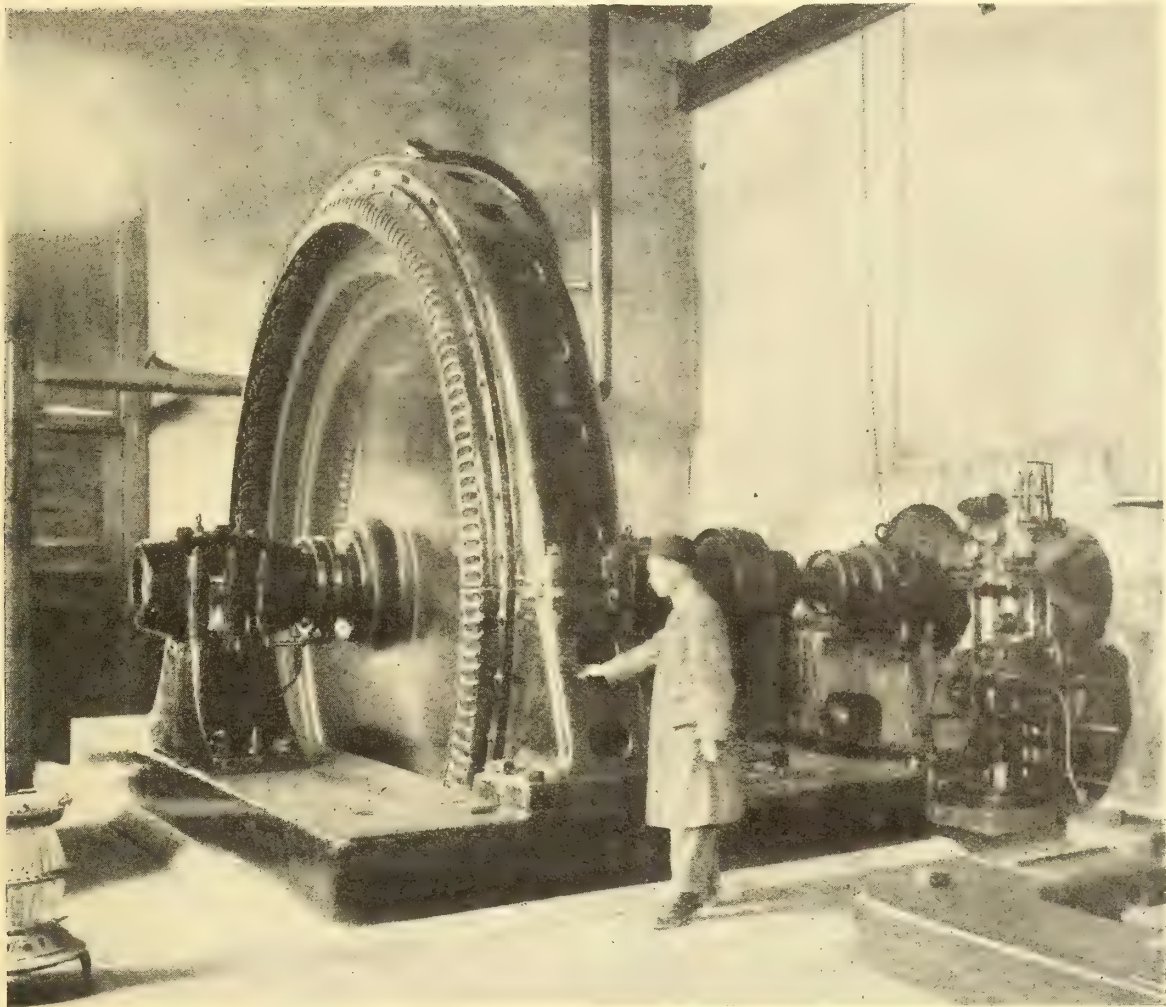
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Branches: Halifax, Toronto, Winnipeg, Vancouver

High Grade Electrical Apparatus



1,250 KW., 120 r.p.m., 2,400 Volts, 3 Phase, 60 Cycle Water Wheel Type Generator
installed 1910 for the Seymour Power and Electric Co., Campbellford, Ont.

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¶ To insure a perfect wiring job, the materials used, as well as the labor employed, must be of the highest order.

¶ Absolute satisfaction is only secured through using those materials which are characterized by the highest refinements of mechanical and electrical proportion and unequalled workmanship.

¶ The lines listed below are made by the most reputable manufacturers on this continent, and have an unchallenged record for durability and dependability. By their use you are assured of the best possible results.

**“GALVADUCT” and “LORICATED” RIGID
IRON CONDUITS**

**“T and B” OUTLET BOXES and COVERS, FLOOR BOXES,
HANGERS and CONDUIT FITTINGS,
CONDULETS, SECTIONAL SWITCH BOXES,
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*For further information regarding prices and
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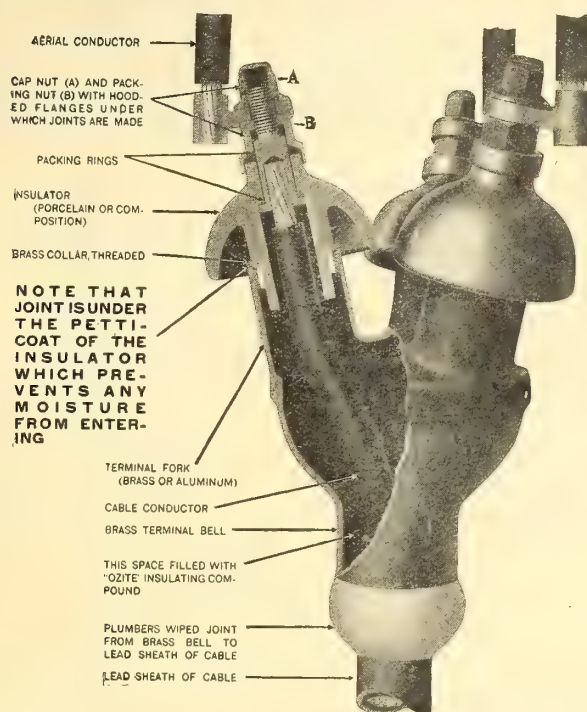


THE Northern Electric
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Manufacturer and Distributor of Telephone Apparatus, Electrical
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MONTREAL HALIFAX TORONTO WINNIPEG REGINA CALGARY EDMONTON VANCOUVER



This is a sectional view of a "STANDARD" D.O.A. (out-door) Terminal for 2500-volt service. It shows the principles of construction which distinguish all "STANDARD" Terminals from the other kind. As you will see, we could make them cheaper by sacrificing certain features which, experience has taught us, are necessary to proper cable protection; but then they would not be "STANDARD" Terminals.

You Are Interested—

not in what *we* say about our products, but in what *our products* say about us. If you were to cut a vertical section through a

Standard ^{D.O.A.}_{D.S.} Cable Terminal

it would make clear our method of constructing terminals to insure perfect protection to the cable insulation.

Put them in service on your lines and they will prove our claims by their durability and economy.

If you are looking for terminals that promote efficient, economical and uninterrupted cable service, we will send you full information about "STANDARD" Terminals and quote prices on any quantity. *Write now.*

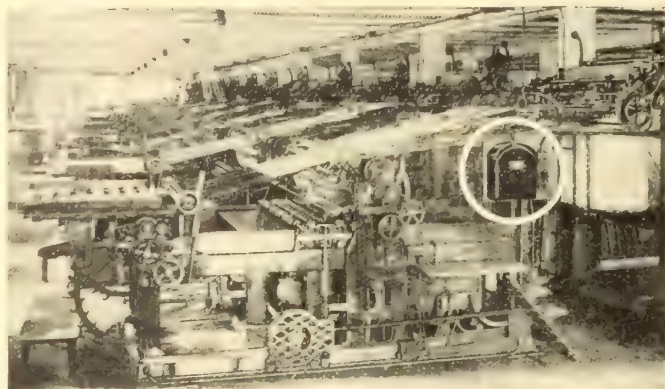
Standard Underground Cable Co., of Canada, Limited

Department E

Hamilton, Ont.

Manufacturers of Electric Wires and Cables of all kinds, all sizes, for all services, also Cable Junction Boxes, etc.

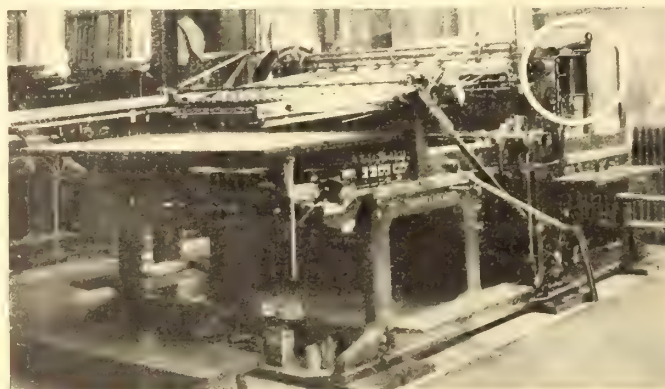
CUTLER-HAMMER



Row of flat-bed presses in plant of Charles Schweinler equipped with the well known "Carpenter" Type controllers. There are 105 Cutler-Hammer controllers in this plant.



Cutler Hammer Kohler type "RF" Automatic controllers in J. J. Little & Ives plant. One of the Push Button stations is indicated in the white circle; the controllers are mounted on the posts back of the presses.



Cutler-Hammer drum type controller on Miehle flat-bed press at Meisenheimer Printing Co., plant, Milwaukee.

Controllers

— for —

Printing Presses

and Allied Machinery

In no specific application of electric power is the use of Cutler-Hammer Control more universal than in printing press drive.

Standard Cutler-Hammer Controllers are made for newspaper presses, for the various types of book, magazine, lithograph and job presses, and for cutters, binders, folders and all the rest of the machines found in the modern printing plant.

In New York it is Difficult to Find a Printing Plant Not Equipped with Cutler-Hammer Control

And there is more printing done in New York than anywhere else.

In the Charles Schweinler plant where many of the national magazines are printed there are 38 "Carpenter" type, 35 Kohler type and 42 starters and speed regulators on the various presses and machines—a total of 105 Cutler-Hammer Controllers.

The second illustration shows the J. J. Little & Ives plant, in which 45 Cutler-Hammer "Kohler" type "RF" Automatic Push Button Controllers and 20 manually operated "Carpenter" Controllers. The pressman controls the functions of acceleration, speed change, stop, tease and safety from the push button station.

Space permits of only a mention of some of the other New York plants using Cutler-Hammer controllers: The Robert Gair Co., Federal Printing Co., American Lithograph Co., Sackett & Wilhelm, Williams Printing Co., George Schlegel Co., Richardson Press, Van Rees Press, Reliance Press, Don Harris & Woodworth, Rutter & Son, American Colortype Co., Blanchard Press, Bradstreets, R. G. Dun & Co., Trow's Directory, Hill Publishing Co., Harper & Bros., Doubleday, Page & Co., S. S. McClure & Co., American Book Co., Winthrop Press, American Bank Note Co., National Printing & Engraving Co., Quadri Color Co., Technical Press, Brooklyn Daily Eagle, Evening Post Job Dept., Bates Advertising Co., Butterick Publishing Co., Collier's, G. Schirmer, music publisher, etc., etc.

For new Printing Press Controller Bulletins address, Cutler-Hammer Printing Press Equipment Dept., Times Building, New York, N. Y., U.S.A.

THE CUTLER-HAMMER MFG. CO. MILWAUKEE

NEW YORK: Hudson Terminal 350 Church Street

CHICAGO: Peoples Gas Bldg.

PITTSBURG: Farmers' Bank Building

BOSTON: 176 Federal Street

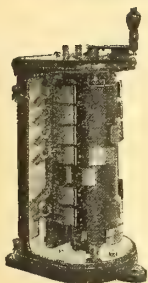
PHILADELPHIA: 1201 Chestnut St.

CLEVELAND: Schofield Building

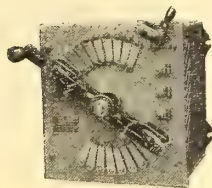
PACIFIC COAST AGENTS: Otis & Squires, 155 New Montgomery Street, SAN FRANCISCO

AGENT FOR SOUTHERN CALIFORNIA: W. B. Palmer, 416 E. 3rd St., LOS ANGELES

CUTLER-HAMMER



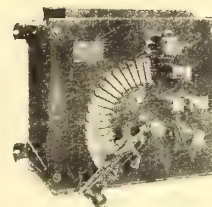
A.C. Starter, Drum Type
Bulletin 9135



A.C. Starter for Slip
Ring Motors of Mod-
erate Capacities
Bulletin 9135



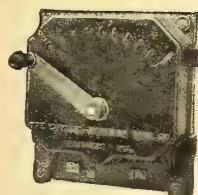
6-in Speed Regulator
for motors 1/20-1/6
H.P.
Bulletin 8529



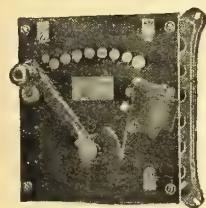
D.C. Motor Starter
Bulletin 2110



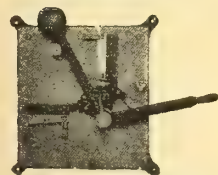
Crane Controller
ask for
Bulletin 5300



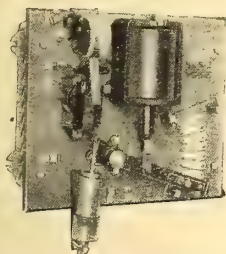
Dust Proof D.C. Motor
Starter
Bulletin 2190



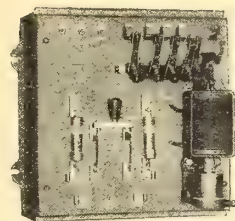
Speed Regulator for
Fans, Pumps, etc.
Bulletin 3110



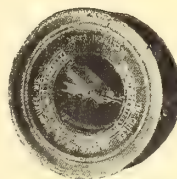
Float Switch for use with
Pumping Equipments
and Self-Starters
Bulletin 6775



D.C. Self-Starter
Bulletin 6110



Automatic Motor Starter
for Pumps, Vacuum
Cleaners, etc.
Bulletin 6100



Gauge Type
Pressure Regulator
Bulletin 6760



Polyphase Motor
Speed Regulator
Bulletin 9320



D.C. Starter with Knife
Switch and Fuses
Bulletin 2150

What You Really Buy is EXPERIENCE

IF you go to a doctor, or to a lawyer for advice, you buy experience—experience expressed in words. We sell experience, also, but our experience is expressed in copper, iron and slate.

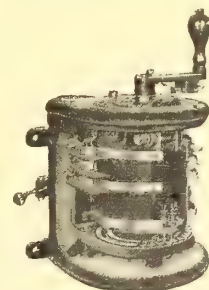
The little Cutler-Hammer Speed Regulator that you buy for a few dollars is the visible expression of twenty years' experience—twenty years of study and experiment—twenty years of concentration on one subject—the control of electric motors.

There is no other company anywhere that has specialized on electric controlling apparatus for so long a time as has the Cutler-Hammer Mfg. Co. There is no other company anywhere that has standardized so many different types of controllers. There is no other company that can serve you as promptly or so well if you want apparatus designed to start, stop or control the speed of an electric motor.

Bulletins on any Class of Apparatus Sent Promptly on Request.



Combined Starting and
Regulating Rheostat
Bulletin 2240



Machine Tool Controller
Bulletin 5220

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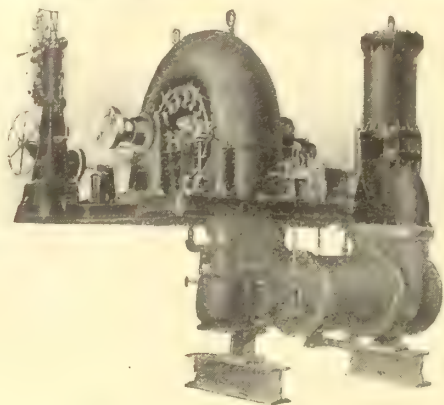
PHILADELPHIA: 1201 Chestnut St.

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AGENT FOR SOUTHERN CALIFORNIA: W. B. Palmer, 416 E. 3rd St., LOS ANGELES

Hydraulic Turbines



One of three units each of
1700 H. P. at 720 R. P. M. 280 ft. Head

These wheels when tested in place
gave over 87% efficiency.

We are now building five 16,000
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foot head.

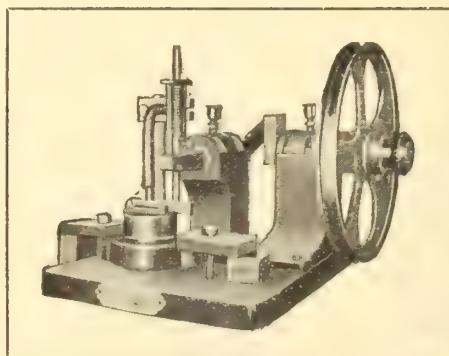
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S. MORGAN SMITH CO.

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A simple inexpensive device designed for the accurate and
automatic regrinding of Brake Valves - \$37.00 net

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P & S Handy Wiring Devices



P & S 61988



P & S 437



P & S 439



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P & S 427



P & S 102703



P & S 102704



P & S 61577



P & S 436

P & S sign receptacles with removable porcelain ring are adapted for use with metal signs as well as outlet boxes.

Each of the devices illustrated above is completely equipped with ring and gasket. The contact shells are thoroughly reinforced, so there is no possibility of the shell being pulled out of place.

Bronze screws are used to fasten the contact shell in place.

You will notice a wide variety of sign receptacles of the porcelain ring type, some with wide ring and some with narrow, some with enclosed contacts, some with open, while others have rubber covered leads.

All of these receptacles as well as many others are completely illustrated in catalog No. 20.

Send for a copy today and specify P & S when ordering of your jobber.

FOR SALE BY ALL JOBBERS

CARRIED IN STOCK BY:

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The New Hubbel Plug "Fifty-8-Fifteen"



**The Smallest Separable Plug
for the Biggest Service**

NO Plug near its size can do so much. No Plug twice its size can do any more.

Measures $1\frac{1}{8}$ inches from base end to cap top. Cap extends about $\frac{1}{2}$ inch from lamp socket.

Contacts embedded in a one-piece porcelain base. No live parts are exposed when connecting or disconnecting.

Cap made of non-breakable composition. Contact blades have rounded ends and notched edges, which are gripped by stiff springs in the base.

Cap and base go together with a click, hold securely never stick. Push-in cap prevents twisting of the cord when making connection.

You must see and test "Fifty-8-Fifteen" to know how much goodness can be packed in a small plug. If you wish a Sample Free, write today. Use your business letter-head.

R. E. T. PRINGLE

TORONTO MONTREAL WINDSOR

Dossert Insulated Connect- ors for Railway Signalling Systems

**Taps from Aluminum Feeders
to Copper Branch Conductors**

**Safe and Efficient Terminals
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**Connectors for THIRD RAIL
Feeders and Car Lighting
Systems.**

Connectors for Conductors of All
Sorts—Stranded, Solid, Flat Strips,
Blocks, Tubing, Stud, etc.

Write for Catalogue Number Five

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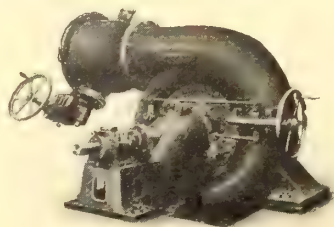
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Type 30 Francis Turbine
1000 B.H.P. 120 Feet Fall

As supplied to Ocean Falls Pulp and Paper Co., Dryden Timber and Power Co. Expert advice at your immediate disposal for estimating purposes, etc.

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Longer Life at Lower Cost



For Satisfying Results in Underground Subway and Power House Construction specify American Bituminized Fiber Conduit. Strongest and most durable conduit made.

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Type "MHS." 2, 3, or 4
Conductor.
30,000 Volts. One of many types.

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NEW AND ORIGINAL IDEAS BY PRACTICAL
ELECTRICAL ENGINEERS

POT HEADS

DETACHABLE, NON-DETACHABLE, COMBINATION
INSIDE AND OUTSIDE USE—ALL VOLTAGES. THE
ORIGINAL POT HEAD WITH WIPING ELIMINATED.

SUBWAY JUNCTION BOXES, SERIES
SWITCHES, COMPOUND, PRIMARY CUT-
OUTS, GROUND-PIPE CAPS, VOLTAGE
DETECTORS, AND MANY OTHER DEVICES

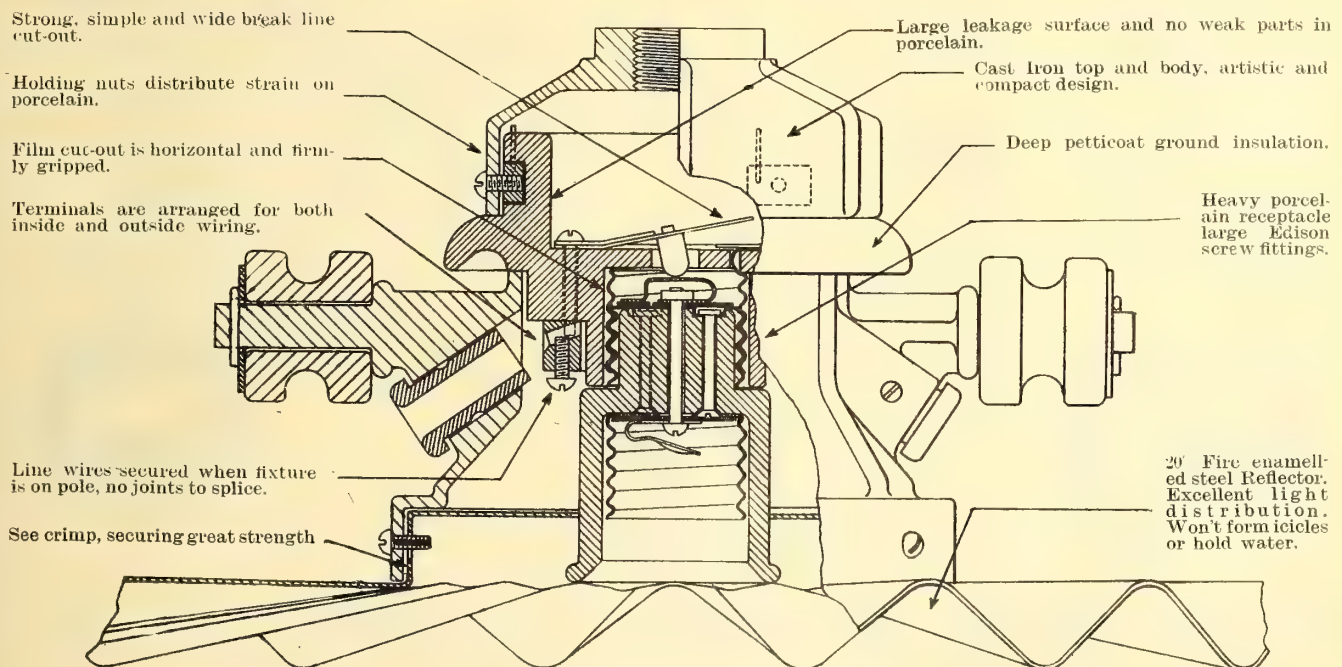
Any pole or manhole can be made a switching and testing
point at small cost through the use of G & W Devices.

We can refer you to many installations in use for
over six years, in many parts of the country.

G & W Electric Specialty Co.
6408 Jackson Park Avenue
CHICAGO, U. S. A.

Note the Good Points of this Lighting Fixture and Send for Bulletin No. 7

No. 18 PEMCO SERIES FIXTURE



76 Bay Street,
TORONTO

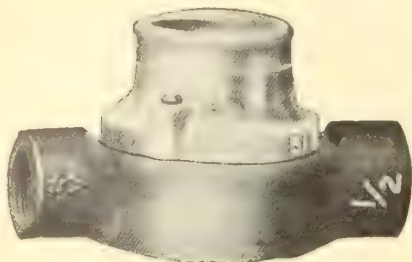
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MADE IN CANADA

Conduit Boxes, Conduit Pipe Fittings, Conduit Accessories, &c.

Drawn Steel Stampings and Clean Castings a Specialty



Type G 1/2" Casting with Receptacle



Service Box

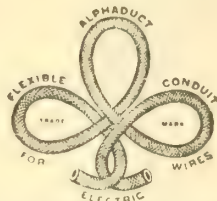
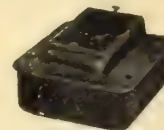
We can also supply steel cutout boxes in any size



Type E 1/2" Casting with 2 wire cover



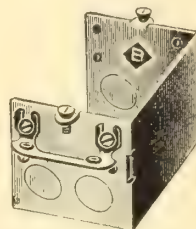
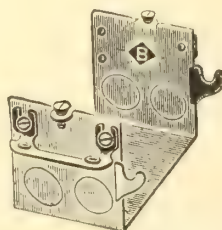
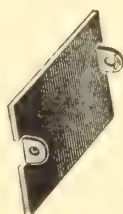
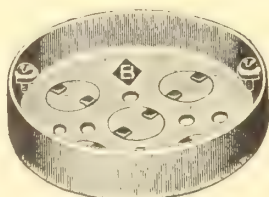
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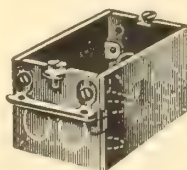
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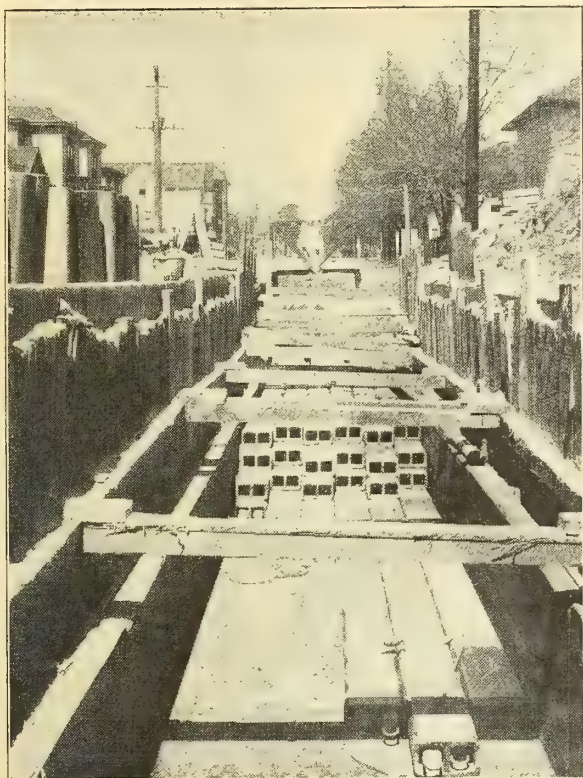
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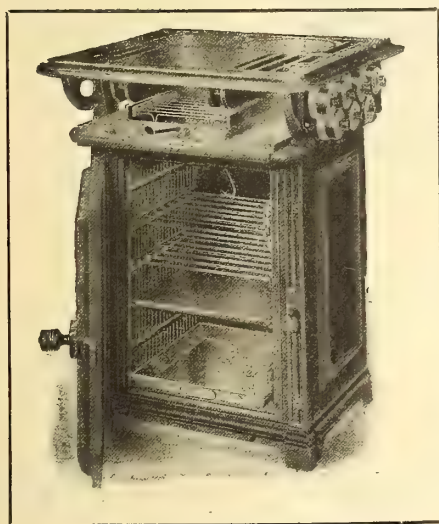
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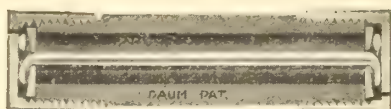
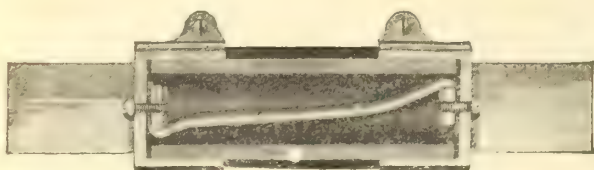
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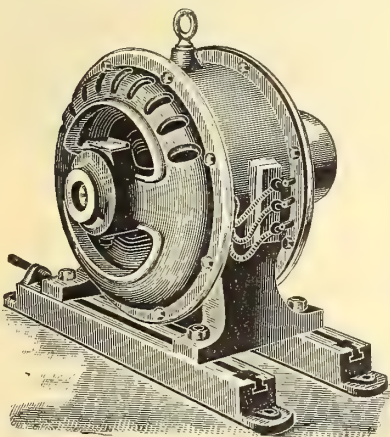
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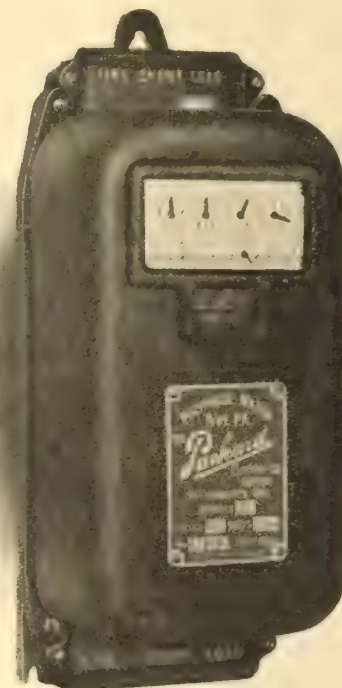
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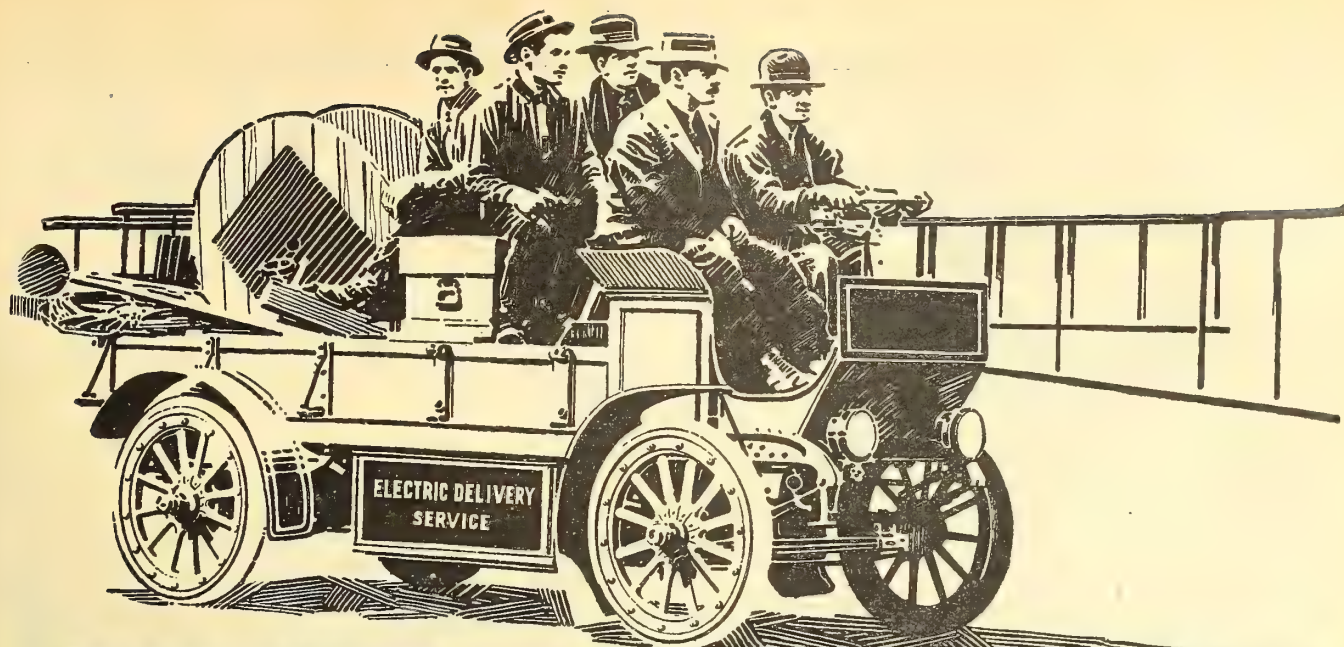
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(16)



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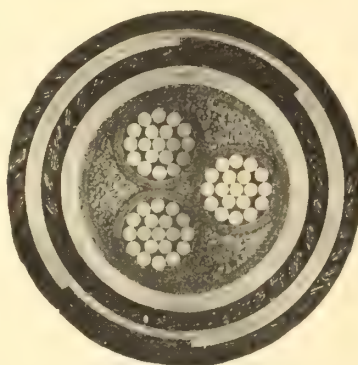
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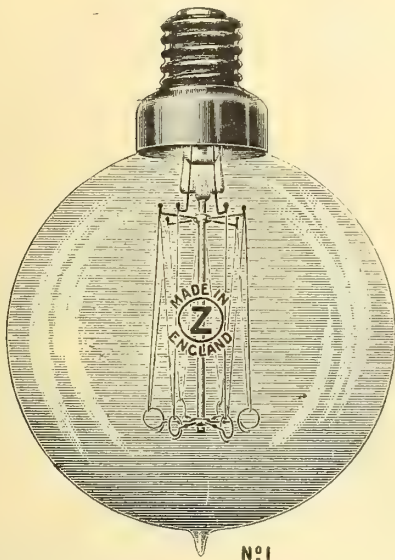
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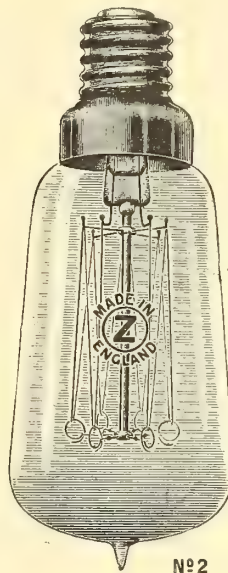
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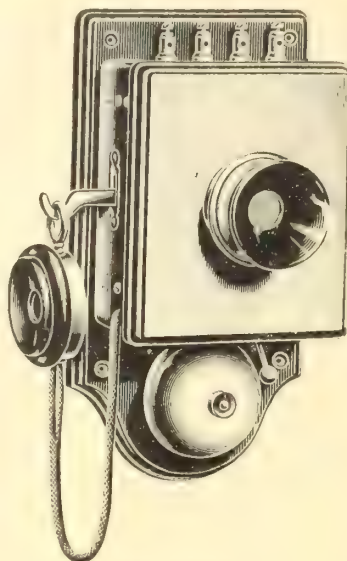
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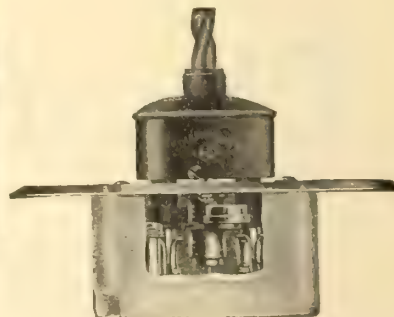
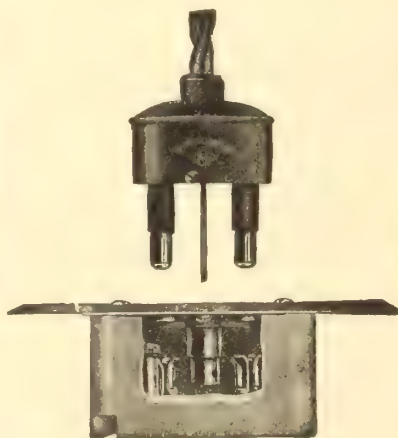
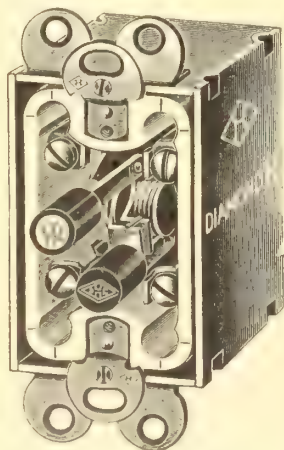
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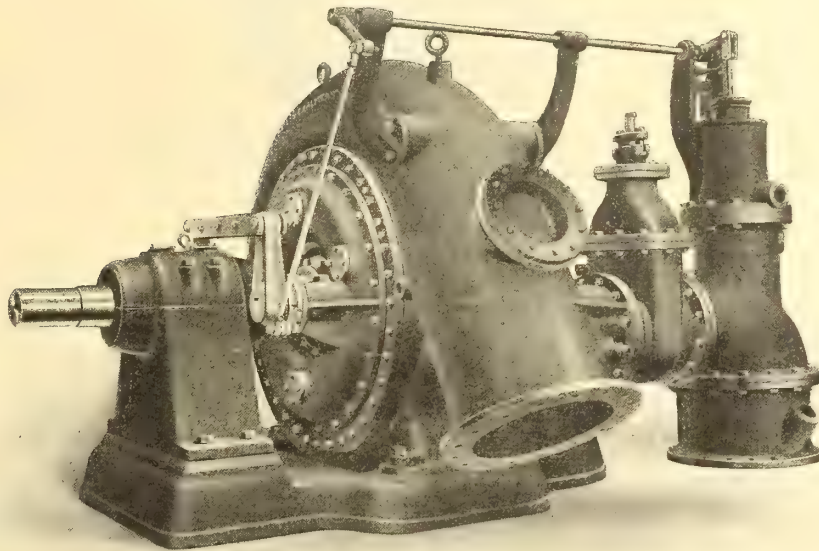
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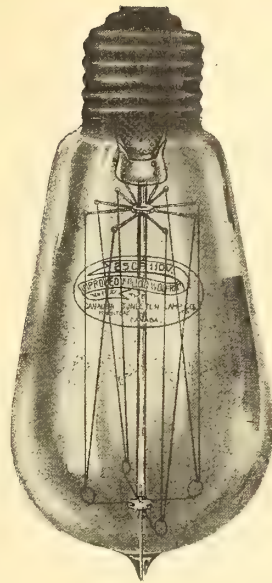
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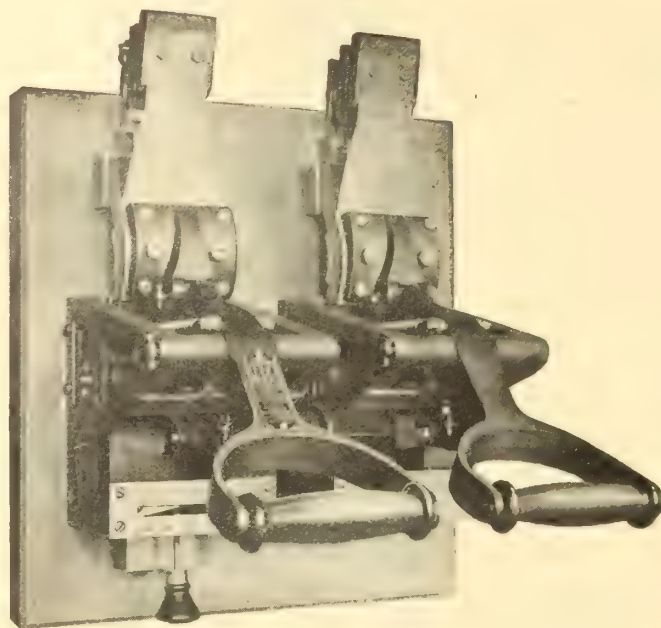
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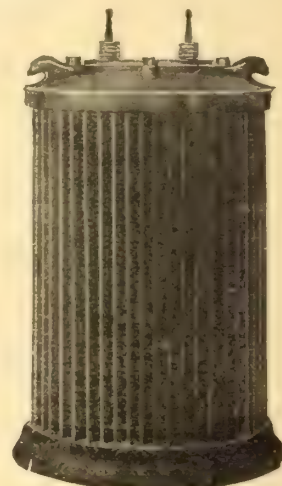
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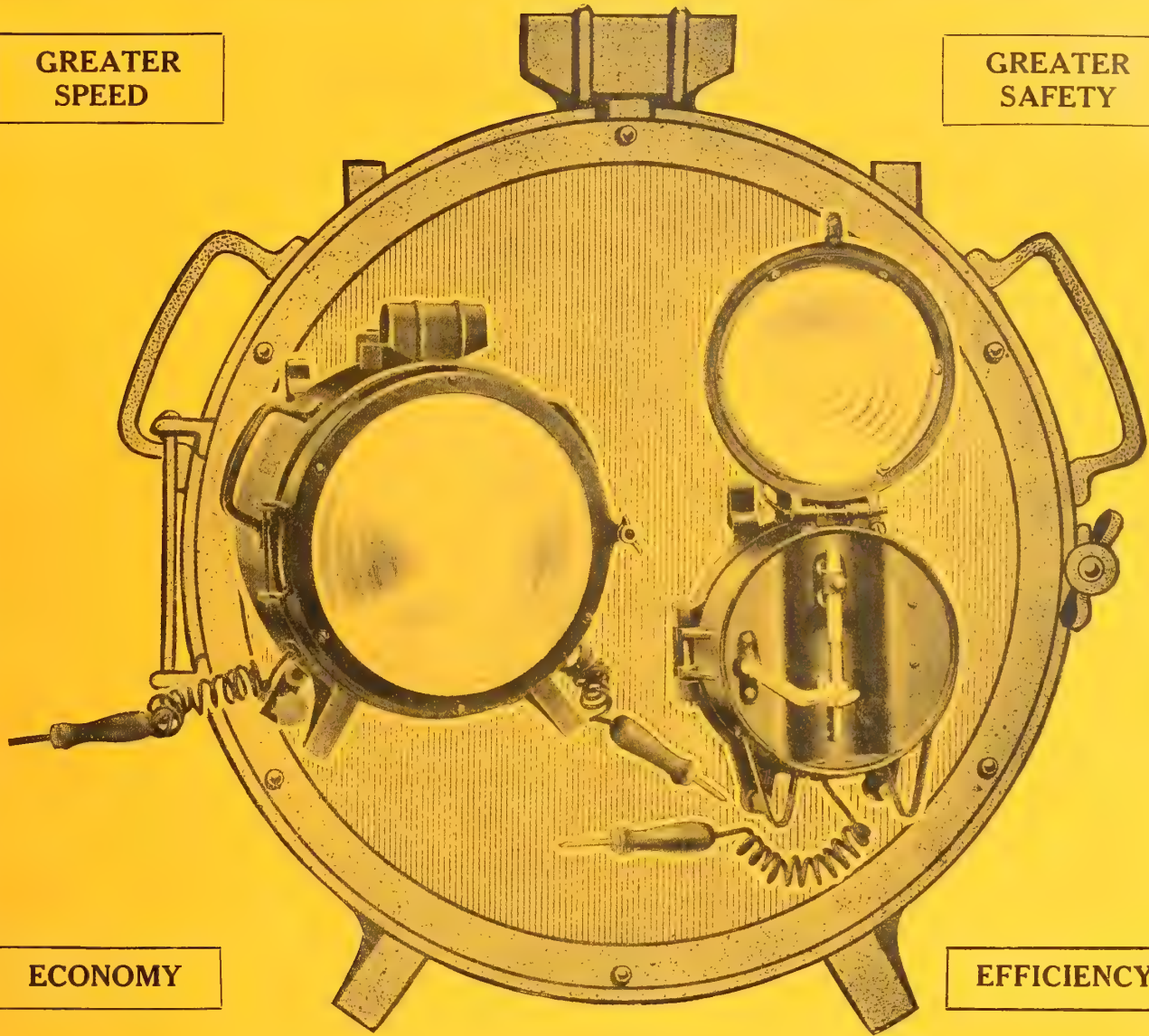
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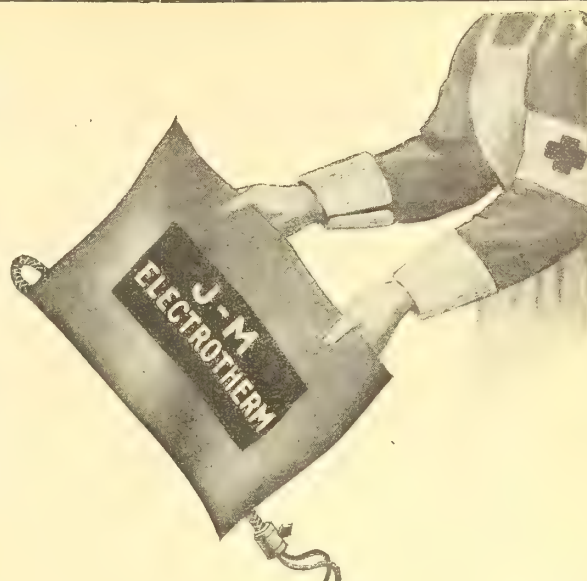
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Moncrieff and Endress Ltd., Winnipeg, Man.

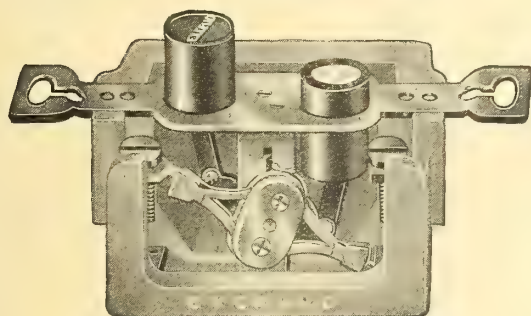


"Excello" Switch Specialties

Are built up to a standard not down to a price

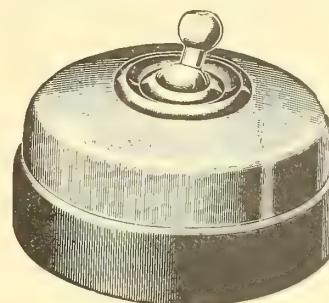
The Excello line of Push Button and Tumbler Switches have been developed with the purpose of giving both the contractor and user absolute satisfaction.

EXCELLO P. B. TYPE



Easy Push and Strong Action
Large contacts and liberal current carrying capacity.

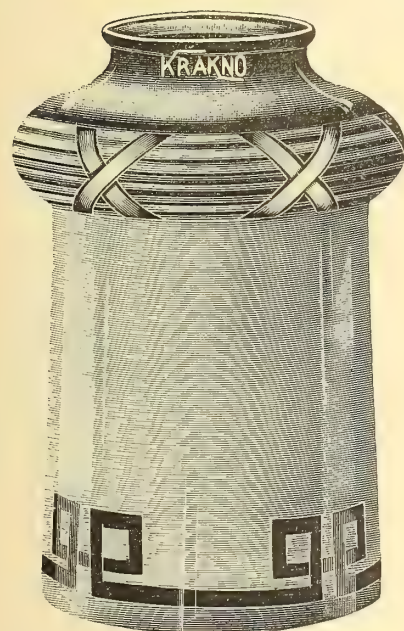
EXCELLO FLAT TYPE



The simple action of an Excello Tumbler Switch is more desirable than the noisy snap action of a Rotary Switch.

Engineering Equipment & Supply Co.

410 St. James Street, MONTREAL



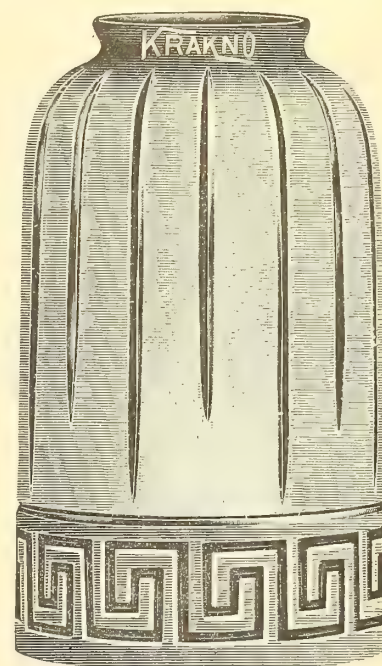
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Sand Blast No. 1
Made in Crystal, Green and
Amber

TRADE
KRAKNO
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Some of our many classy
—artistic effects in illu-
minating Glass Ware.

Write for catalogue and
price list.

It will pay you.



1301
Made in Crystal and
Amber

Krakno Glass Co., 210 Fourth Ave., Pittsburg, Pa.



MARSHALL - DAVIS
 — LIMITED —
 ELECTRICAL APPLIANCES
 DUNNVILLE, - ONTARIO



RAILWAY TELEPHONE SYSTEMS

Telephone and Telegraph Construction Material

TALK No. 4 BY

The Mainer Electric Company, Limited

And now it's time to particularize; but if you missed reading the other talks you won't appreciate fully the monthly progress of the MAINER ELECTRIC COMPANY, LIMITED.

Messrs. Couch & Company, one of America's most successful "Phone" makers, had entrusted the distribution of his goods for Western Canada, to us. We are stocking Couch interior telephones and already have sold a few sets.

The telephone business we are after just now is **Apartment House Sets**, either surface or flush, comprising janitors' 'phone, suite 'phones and for vestibule, covering any number of suites.

Private House 'Phones, up to four numbers, easily installed, perfect in operation, price within the reach of the average householder.

'Phone sets for the office and warehouse, to ten stations, intercommunicating, non-interfering.

School Sets, as adopted by the Chicago Board of Education, and other educational bodies.

We are in a position to offer the electrical contractor, a neat, cheap, concrete 'phone proposition covering just what he requires, also we have a special data book that would be of much value to architects and prospective builders. Write for copy of catalog.

The Mainer Electric Company, Limited

61-63 Albert Street, WINNIPEG, MANITOBA



MICATENE

H. WEIDMANN, RAPPERSWIL, SWITZERLAND

Specialist in the manufacture of

3

PRESSPAN—(Pressboard)

BEST QUALITY, PROVED BY REPEATED TESTS

Sheets in thickness from 0.1 mm. upwards.

Endless Rolls and Strips 0.1 to 1 mm. thickness.

BLACK PRESSPAN IN SHEETS, ROLLS AND STRIPS

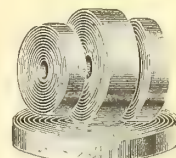
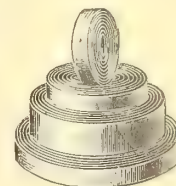
Presspan Coils and Tubes for Transformers, Armatures, Discs and Shaped Articles.

VARNISHED PRESSPAN, MICA-COVERED PRESSPAN, &c.

MICATENE (Micanite) in plates, hard and flexible

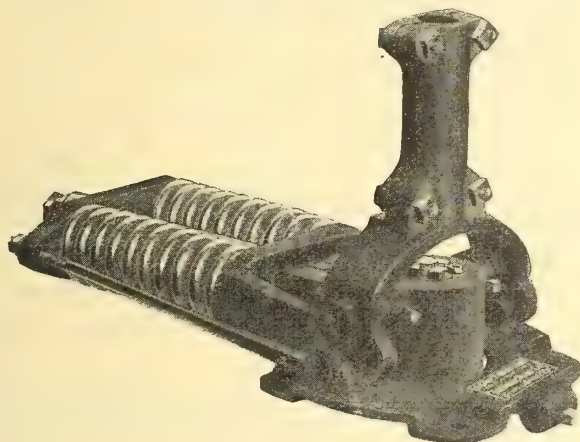
Micapapers, Mica clothes, Mica insulating pieces.

Tubes for Generators and Transformers in Cartogene (insulating paper with and without Mica.



PRESSPAN

The Star Roller Bearing Trolley Base



It is worth more, but sells for less than any other Trolley Base.

The roller bearing—one of the strongest features consists of eight especially treated and hardened rolls in a malleable cage, running in a specially treated steel bushing against a 1½" steel centre post, practically indestructible.

The Star Base is of strong construction, simple and very durable. Sold under a guarantee.

Will send sample to any point in Canada, freight prepaid, for a test; to be returned at our expense if not satisfactory.

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is the guarantee of the highest perfection that modern facilities attain in the manufacture of

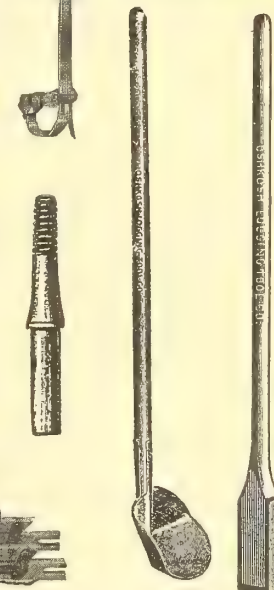
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Our catalogue tells the story. Get one. It will simplify your construction problem.

Oshkosh Mfg. Co.

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Suitable for Switch or Open Conduit work—having a complete line of Covers for all styles of Attachments, Drop Cord, Fixture, Receptacles, etc.

May we send you a sample?—Write to-day

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Represented by

Central Electric & School Supply Co., TORONTO, ONT.



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ON A BUSINESS SYSTEM

Use C & H **TWO-RATE** Meters

Watch your load factor improve on a system which the consumer understands. Write to us we'll tell you about it.

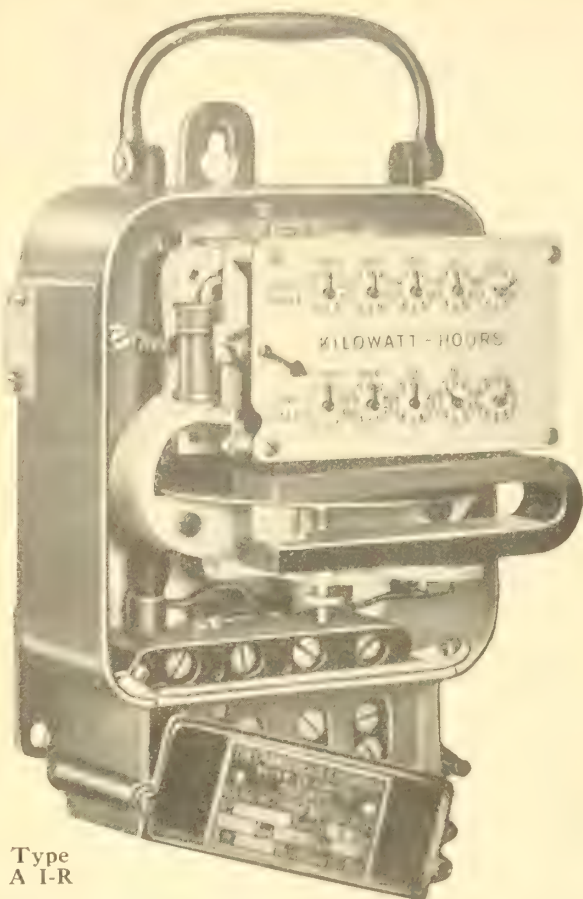
**The Chamberlain & Hookham
Meter Co., Limited**

312 Kent Building - TORONTO

Meter and Time Switch Specialists

Cablegrams:—Meters, Toronto

Telephone Main 7791



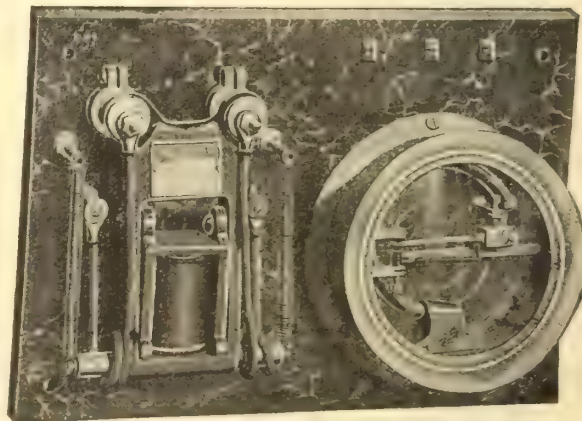
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A I-R

Perfect Pressure Control

Can be obtained in tanks and reservoirs by starting and stopping the motor driven apparatus with

THE SUNDH GAUGE TYPE REGULATOR

The simplest, strongest and most satisfactory regulator made. Operates on a pressure difference of 3 to 5 per cent. of maximum pressure. Wider range may be obtained by screwing down the left hand screw.



The construction consists of a silver-tipped contact lever attached to the tube and moving between two silver contact points on pressure fluctuations.

The screw on the right is used for adjusting to maximum pressure desired, and the lower screw on left hand is for adjusting for difference in pressure.

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New York, U.S.A.

Represented by the C. H. L. Keeler Company, Limited, Toronto, Canada

Electrical Supplies

of the very highest quality have always been our product. The result has been *absolute satisfaction* among our customers as is shown by the fact that our business increased 35% in our fiscal year just ended.

This Trademark



is Your Guarantee

which we put on all our goods to show our own faith in them and to demonstrate our readiness to back up our product.

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Have you a copy of our new catalog—red hot from the press.

If not tell us—we'll hustle, one to you.

The **Duncan Electrical Co.,**
Limited
Montreal

Makers of "Duncan Quality" Electrical Supplies

ADANAC Red Core Rubber Covered WIRES & CABLES



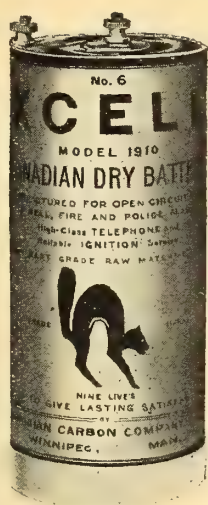
Adanac Red Core Rubber Covered Wires and Cables

are made according to the specifications of the National Board of Fire Underwriters. The conductors are drawn from copper of the highest conductivity and are covered with two thicknesses of thoroughly vulcanized rubber compound of high quality. The wires are braided over insulation and the smooth high finish they receive makes them specially desirable for conduit work.

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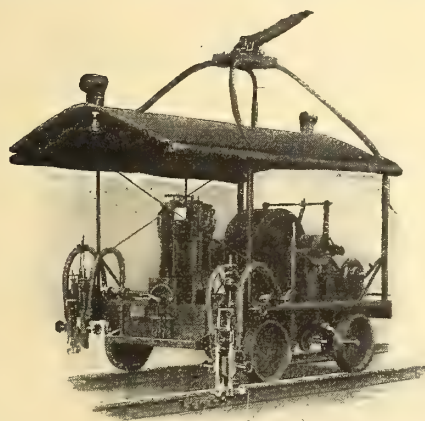
are never more than five days old when they reach dealers. We are getting high praise for our heavy duty cell, No. 8. It is known as a cell that furnishes efficient, reliable ignition steadily during a long life.

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A copy will be sent, duty prepaid, at your request.

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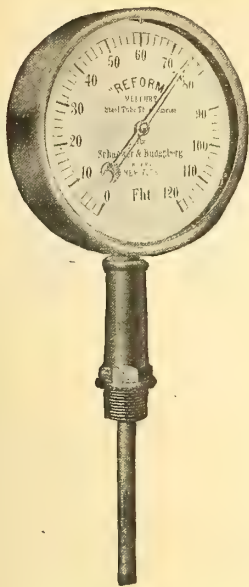
Let us quote you prices

It will save you money

Dawson & Company

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In the "Reform" Thermometer

is embodied the accuracy of the standard glass tube thermometer and the advantages of a dial face instrument. The secret of its extreme accuracy lies in the fact that the "Reform" Thermometer is actuated by mercury, the best substance in existence for measuring temperature. Troubles experienced in reading scale type thermometers are eliminated by the dial face of the "Reform." To

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There are many more features—Know about them. Write for bulletin H 101 Now.

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A Holiday Profit Maker for Electrical Men

Crescent Coloring Fluid For Incandescent Lamps



Attractive Christmas and Holiday Decorations are yearly becoming more popular and in greater demand.

There's a big chance for you to pluck some worth-while profits on this quick selling specialty, with little effort. But you must get at it without delay, for the selling season is at hand.

CRESCENT COLORING FLUID produces beautiful effects and gives the best imitation of real colored glass possible to obtain. Lamps colored with it have an unusual snap and brilliance. It is made in Nine Colors and Frosting and is guaranteed absolutely satisfying.

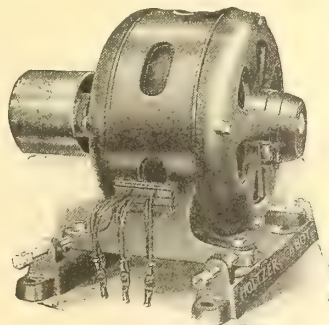
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Write us to-day for net quantity prices.*

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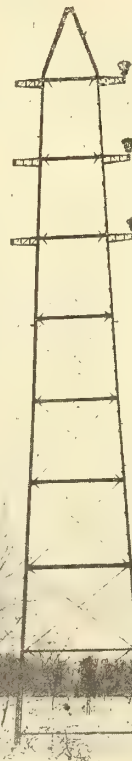
Where special conditions of **weight, size, torque, speed, overload, efficiency** are required—that is where we come in.

Single Phase Motors
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Dynamotors
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The Holtzer-Cabot Electric Co.
Boston and Chicago

Steel Transmission Structures



□ The cut shows the type of flexible "A" frames recently erected for a 34 mile line from St. Catharines to Hamilton. These are 47 feet high and 9 feet wide at the ground. Placed approximately 400 feet apart along the line.

This line has worked out at a cost very little in excess of a wooden pole line. If you have a new transmission line to build or a wooden pole line to rebuild, write us.

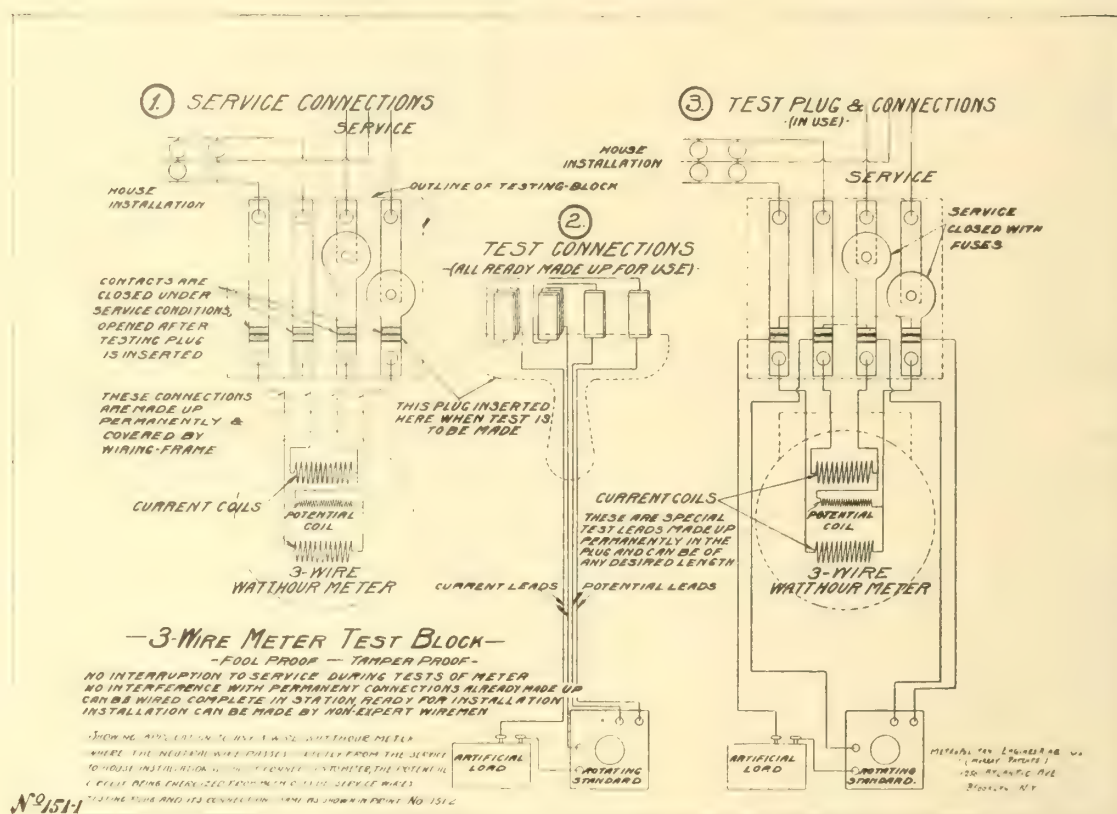
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MURRAY PATENTS

METROPOLITAN Protective and Meter Testing Devices



Diagrammatic scheme of both service and testing connections for 2-wire meters

The above wiring diagram strikingly illustrates how Meter Testing can be simplified by the use of Metropolitan Devices. To safely By-pass the customer's installation, maintain the same polarity, place the meter fields in series and make such other connections as are necessary, in preparing the meter for test, at the same time not disturbing any permanent connections, all of this being done by one simple operation, is the advantage which this device offers.

Metropolitan Engineering Company

90 SHERBOURNE ST.

Toronto

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For Industrial Lighting

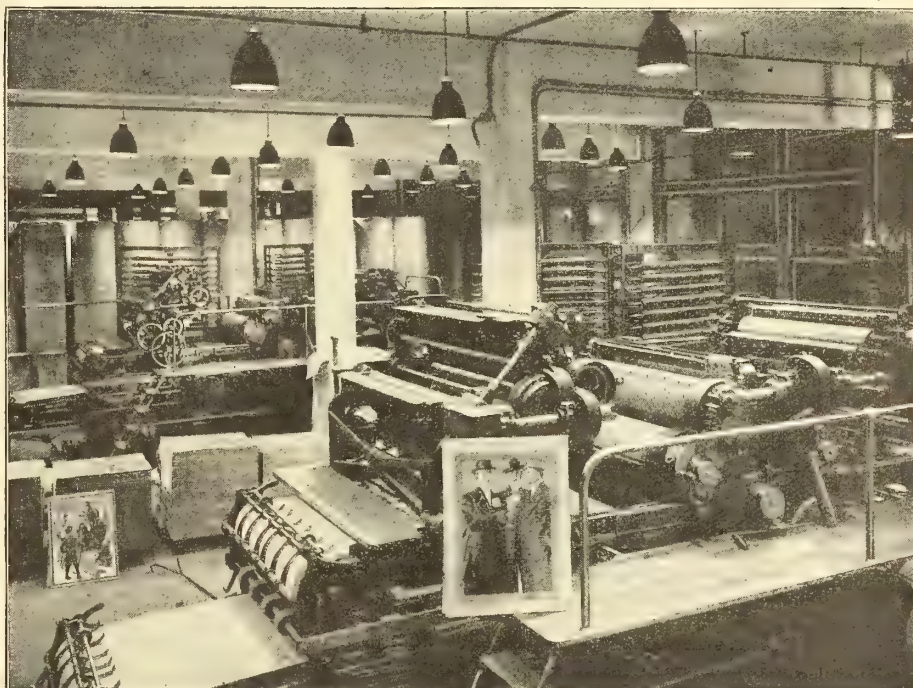
The X-Ray "Beehive" Reflector

**Efficiency
Highest
Known**

The "Beehive" is the only reflector made which *hides* the glaring lamp from the eye, and *distributes* a white light evenly on the working plane. Its efficiency is *permanent*.

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80 "Beehives."



The Lion M Tungsten Lamps



**The Ideal Lamp for
Business Premises**

Strong, reliable manufacture,
Long Life, More Light all the
the time. Specially adapted
for use in Offices, Stores and
Factories.

TO THE TRADE

We are now ready to fill large or
small orders from stock and make
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Special prices and discounts on
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In lots of 1,000 and over, we etch
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Samples submitted for testing.

*Special quotations made on request
write us your requirements*

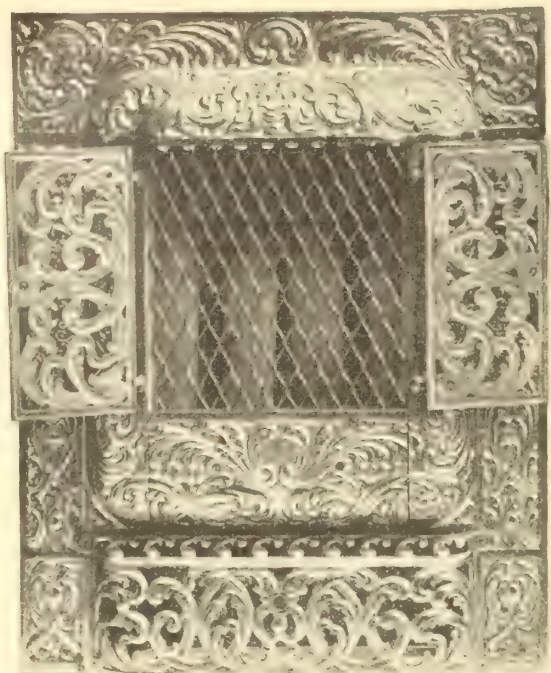
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(Tel. Main 2298)

Toronto

RADIANT Electric Heating Appliances



"Renaissance" Fire Place Heater

Black..... \$30.00 Fits fire-place—
 Oxidized Copper..... \$30.00 20 to 23 inches wide.
 Brush Brass..... \$33.50 28 to 30 inches high.
 Has three heats—High, Medium and Low.



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Radiant Percolator and disc stove held together by a single bolt. The pot can be used on any stove, while the disc may be used to heat other small vessels.



"Dolphin Radiator"

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Two Heats—High and Low.

Radiant Electric Heating Appliances

are Safe, Clean,
 Economical and
 Convenient

Manufactured with the best material, fitted with the most modern up-to-date devices and finished in attractive designs to suit any style of decoration.



"La Belle"

3-Lamp Luminous Radiator furnished in oxidized copper only. Will give greater heat than any other radiator using same amount of electricity.

Catalogue and full particulars on request—Write to

Radiant Electric Company, Limited

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**Drawn Wire "MAZDA" Lamp is
a Real Lamp with Real Results**

Chemically pure Tungsten metal actually drawn in the form of Wire composes the Filament of **Sunbeam Drawn Wire "MAZDA" Lamps** making them as rugged as the present Carbon Lamp.

Sunbeam Mazda Carbon and Gem Lamps
Have Often Been
Imitated but Never Equalled

The Label is the Guarantee of QUALITY

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Limited

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Veluria

Cut and Etched

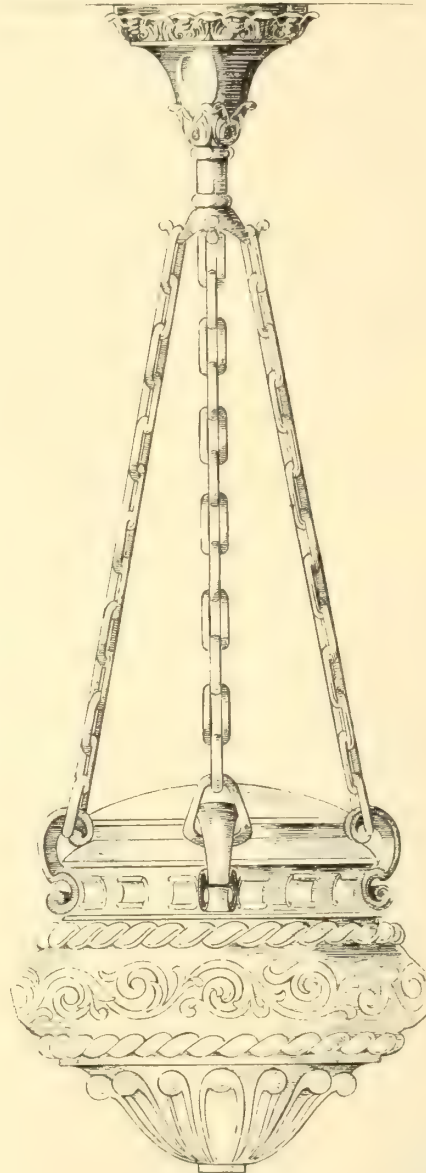
Holophane

The Veluria Urnolite

The glass beautiful—mellow, rich and efficient under light, resembling carved alabaster when not

One only
of the many
beautiful
new lighting
units of
The
Holophane
Company
Limited

Order Samples
at once



Two Piece
Veluria
10-12 and 16 in.
Spheres
also other
Enclosed and
Semi-Indirect
Lighting
Units

Write for prices
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THE NEW URNOLITE

(Suggestion for fixture, we furnish the glass only)

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Toronto

Iris

Steel and Porcelain Enamel Reflectors

Pyro



Service vs. Efficiency in High Voltage Insulators

A donkey hoist engine may use 75 lbs. of steam per horse-power ; a compound Corliss 20 lbs. One is intended to meet highly variable, the other constant conditions. No fear, however, of your using a Corliss for hoisting.

About once or twice each year high voltage insulators are called upon to carry their full load for a very short time and it is intended that "Victor" insulators will carry safely over those peaks. That's service.

"Victor" insulators do not provide the most spectacular laboratory tests per unit expenditure, but there has been thoughtfully provided in their design and material a reserve strength that is invaluable in a pinch.

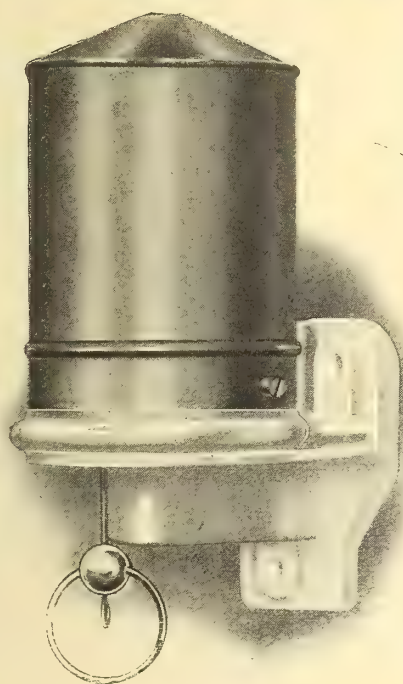
THE LOCKE INSULATOR MFG. CO., Victor, N. Y.

OR

Engineering Equipment & Supply Company

410 St. James Street,
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FLAT RATE CONTROLLER



Satisfies Your Customer
Reduces Operating Costs
Eliminates Meter Disputes
Smallest, Lightest and Most Durable
on the Market

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Made in All Capacities
up to 5 Amperes

The Only Reliable Controller For
Tungsten Lamps

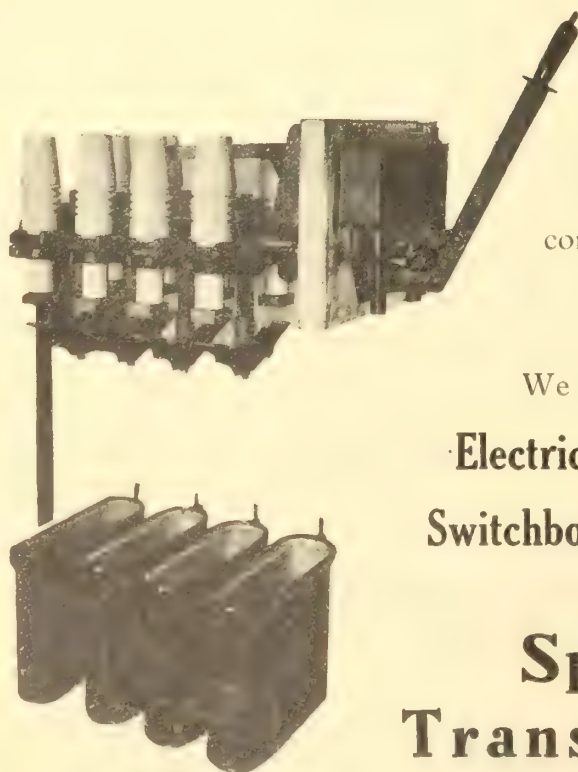
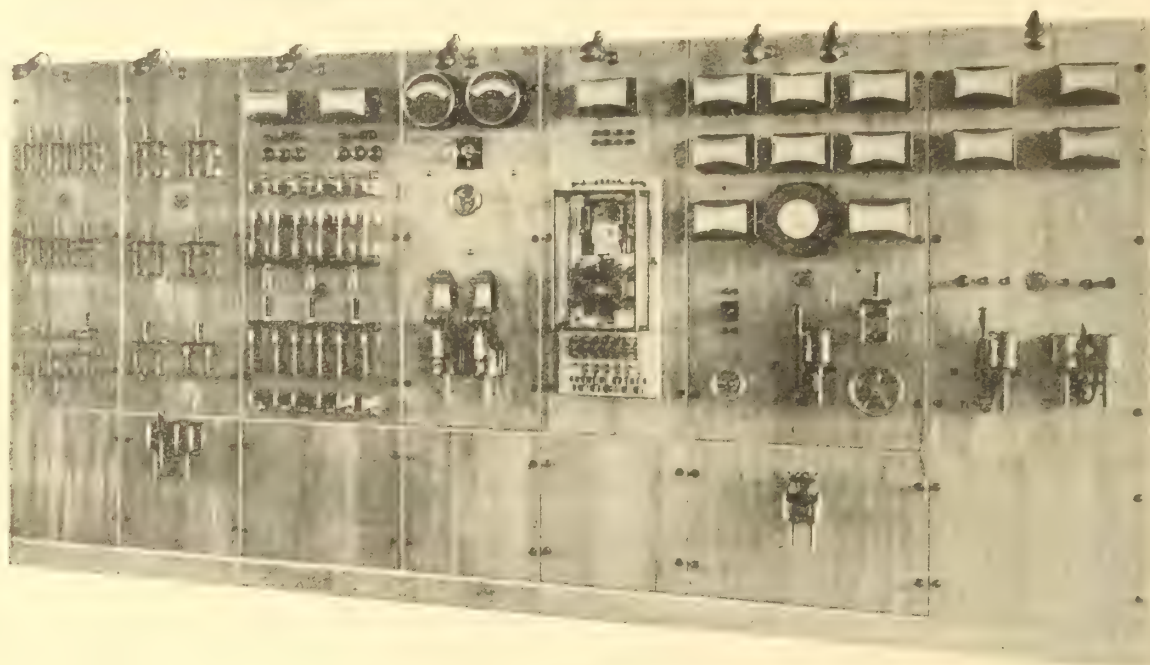
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MONTREAL

Monarch Electric Co., Limited

PHONE: Main 3988
Montreal Exchange

St. Lambert, P. Q.

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Any Opportunity to Build to Your Specifications

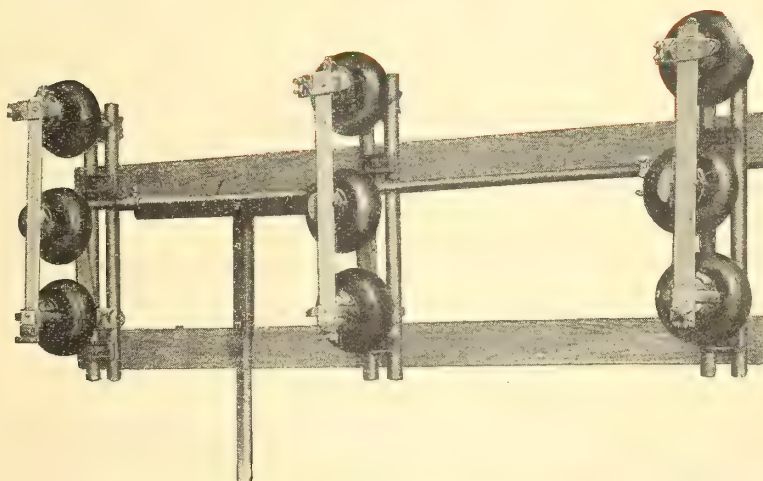
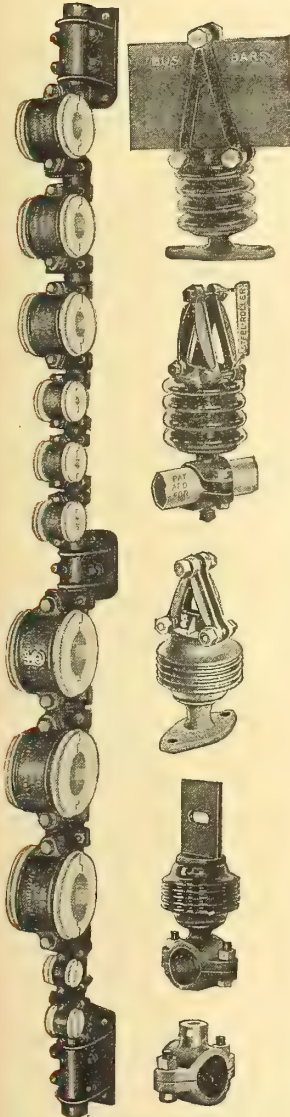
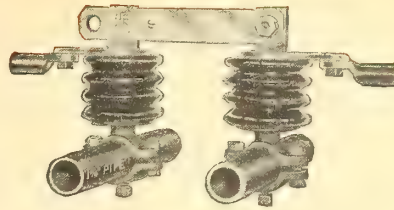
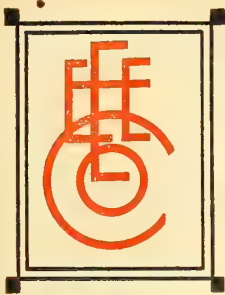


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Circuit Breaker
Laminated Con-
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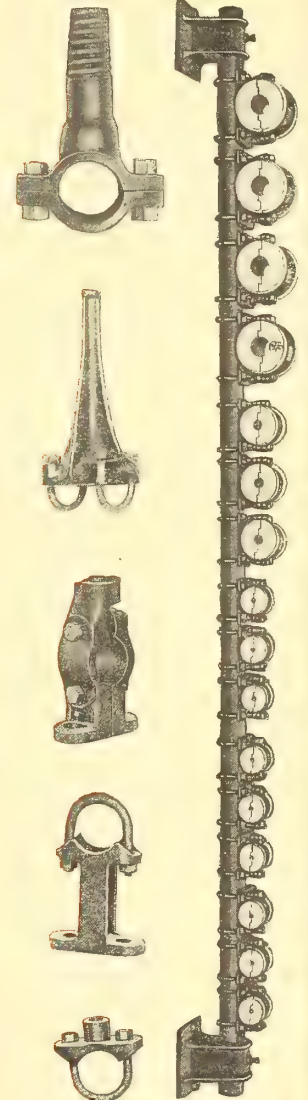
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Electrical Specialties,
Switchboards, Switches.

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High Tension Pole Top Switch



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**ALL Cable End Bells
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Cable Terminals**

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Triple Pole Outdoor Type Pole
Top Disconnecting Switches
Bus Bar Supports for Pipe and Flat Mount-
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Switchboard Pipe Fittings
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Insulators, Bushings, Tapes, Etc.
Special Copper Fittings

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Notice—We own Canadian Patents No. 126336 and
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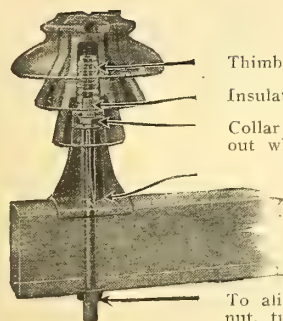
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Thimble is cemented to insulator.

Insulator screws to stud bolt here.

Collar preventing stud bolt from dropping out when insulator is removed.

The design of the base prevents turning adds greatly to the strength, and prevents rotting of the wood at the bolt holes.

To align insulator with the wire, loosen this nut, turn insulator; then tighten again.

This phantom cut shows what the pin is, and some of the things it does. Study it over.

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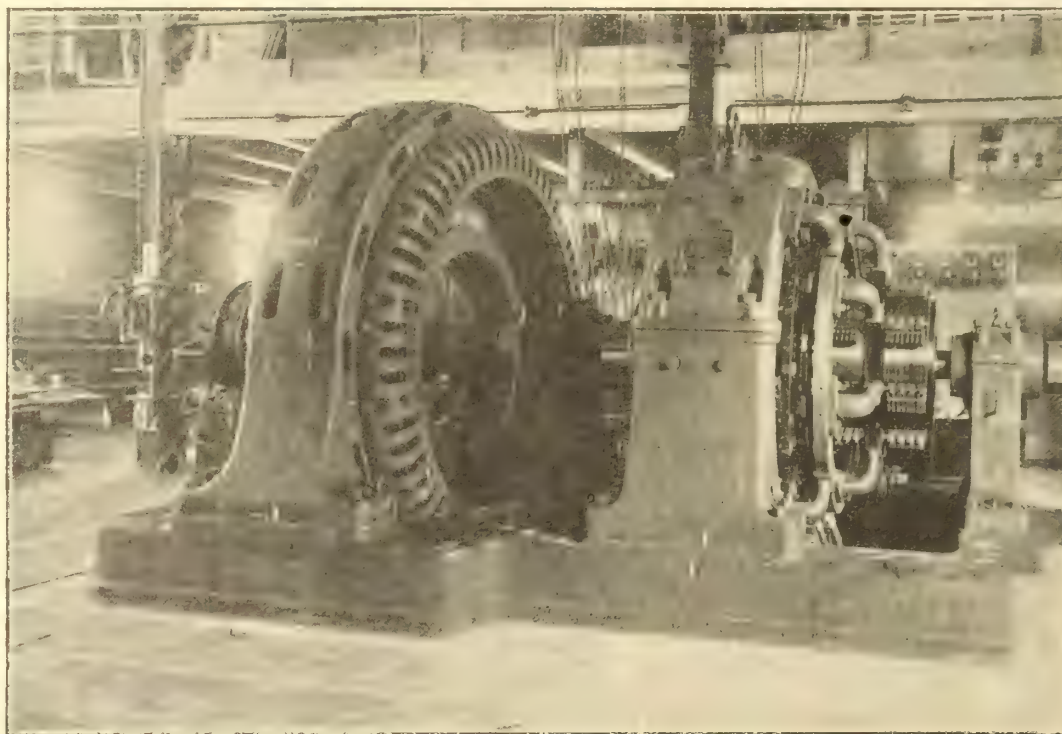
SIEMENS BROS. DYNAMO WORKS

SIEMENS BROS. & CO.

SIEMENS

SIEMENS - SCHUCKERTWERKE

SIEMENS & HALSKE



Siemens 500 K. W. 450 R. P. M. 550-600 Volt Street Railway Motor Generator with synchronous motor supplied and installed for the City of Port Arthur

The above set has been running satisfactorily since August, 1911. A repeat order was obtained for a duplicate set from the City of Port Arthur. Attention is especially drawn to Siemens two-piece commutator shown above. This type of construction has been standard with us for a number of years and used when the length of commutator exceeds about 11 inches. The two sections are on the same bolts and connected by lugs so arranged as to form vanes and produce a current of air to pass between the two sections. This arrangement strengthens the mechanical construction of the commutator, and in addition the following advantages are obtained:—

Thorough Ventilation, Cool Running Assured, Short Commutator Bars Used, Distortion Due to Temperature or Mechanical Stresses Avoided, Surface Always in Good Condition. Brush Spindle Supported from Middle of Short Rigid Support.

We have supplied or on order, amongst others, the following motor generators:

One 800 K.W.—Canadian Collieries.
One 800 K.W.—Dominion Coal Company.
One 700 K.W.—Canadian Collieries.
Two 500 K.W.—City of Port Arthur.

Two 500 K.W.—City of Winnipeg.
One 400 K.W.—City of Lethbridge.
One 200 K.W.—City of Lethbridge.
One 100 K.W.—Northern Ontario Light & Power Company.

Siemens Company of Canada, Limited

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Orders for advertising should reach the office of publication not later than the 20th day of the month preceding date of issue. Changes in advertisements will be made whenever desired, without cost to the advertiser.

SUBSCRIBERS

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Vol. 21

Toronto, November, 1912

No. 11

Cost Data

Nothing is more difficult to gauge beforehand in construction work, electrical or otherwise, than costs. Conditions vary over a wide range—labor troubles, scarcity of material, adverse weather conditions all have their effect as well as unforeseen delays and expenses due to a hundred little causes. And of all mis-calculations, the ones which give the most trouble and upset the plans most are often the little ones—costs that had been overlooked on account of their supposed insignificance—which, when taken together, add up to such large totals as often to represent the difference between success and failure.

The habit of keeping a record of the cost of every little item of construction or operation work is certain, sooner or later, to prove a valuable asset to the man who develops it. It enables him to place his finger at once on the items that are costing more than they should cost. It adjusts his ideas of the relative values of the items to be considered and it enables him to discriminate, next time, between the conditions that are variable and those that remain unchanged, so that he can regulate his figures of cost accordingly. Further, knowing the proper cost of any certain piece of work he is able to form correct judgments of the value of the men he employs when he compares their actual figures with his own.

On other pages of this issue we print cost data on actual construction operations in widely different localities and under quite different conditions. The figures this month will be of value to electric railway men particularly as they treat of electric railway construction, but it is our intention to print, from time to time, similar figures with reference to costs in all lines of electrical work. As mentioned above the little things are often the ones to cause most trouble and

we shall be pleased to receive for publication, from our readers, cost figures on any work, however small or insignificant, that may have been carried out under their supervision. The removal of scrap, unloading or hauling of materials, losses in changing over from one piece of work to another, or similar items will be as valuable to many as more expensive work. We ask our readers to co-operate with us in making this feature as generally useful as possible.

Our Special Issue

The present issue of the Electrical News is devoted in large measure to electric railway matters in recognition of the growing importance of this section of the electrical industry. It is not claimed that the subject of street railways can be covered, even superficially, in one issue, but it is our endeavor to keep our readers advised in this way of the progress that has been made during the past year and to give a general, if brief, review of the street railway situation.

The outstanding advance of the past year in Canada would appear to be the introduction of the gas-electric car. This, because it means transportation service to the great rural populations of the present and future, at a reasonable cost. The storage battery car too, will have to be reckoned with in the near future. In the larger centres the problem of congestion at certain hours is the most urgent of solution and is being met in many large cities by improvement in car design. That much can be done in this direction is evidenced by the rapidity with which the p.a.y.e. and pay-within idea has taken hold. The advent of the latter too is welcome as being specially adapted to the prevention of accidents, a factor of great importance in large cities. The day of the underground does not yet appear to have arrived, for Canada, chiefly on account of the almost prohibitive expense of installation, but later improvements may be the means of overcoming this obstacle. In this connection we may mention the Kearney system described briefly elsewhere in this issue. However, no better proof of the general activity in the electric railway industry in Canada is needed than our brief review of progress and extensions. There is every evidence in this review that we are on the eve of tremendous expansion along the lines of electrical transportation.

Important Scholarships

The Engineering Alumni Association of the University of Toronto have awarded, with the approval of the University authorities, two research scholarships, one of which, awarded to W. P. Dobson, B.A.Sc., an honor graduate in Electrical Engineering, will be followed with increasing interest by those engaged in the electrical industry. Mr. Dobson will make an oscillographic investigation of the transient electrical phenomena produced in high tension circuits by switching on and off large amounts of power under varying conditions. He will operate on the transmission lines of the Hydro-electric Power Commission of Ontario and on the distribution lines of the Toronto Hydro-electric System, the latter affording splendid facilities for thorough investigation owing to the multiplicity of its circuits. Mr. Dobson will work under the guidance of Professors Rosebrugh and Price of the Department of Engineering in the Faculty of Applied Science.

A similar scholarship to M. R. Shaw, B.A.Sc., deals with an investigation of the oils obtained from resinous woods. This research will be under the direction of Dr. Ellis and Professor Bain in the Department of Chemical Engineering.

These scholarships are of the yearly value of \$500 each

and are tenable for one year. The movement was founded several years ago by the graduates in Toronto, the object being to establish and maintain research scholarships by contributions received from the graduate body of the Faculty of Applied Science and Engineering, or of what was formerly known as the School of Practical Science. Funds sufficient to finance two scholarships per year for a number of years have already been subscribed, and steps are being taken to facilitate the selection of men and problems by co-operation with the various departments in the Faculty of Engineering through which the applicant has passed while taking his University course.

The Engineering Alumni Association has its main branch in Toronto but has healthy branch organizations in Montreal, Vancouver, New York, Pittsburgh and the Temiskaming District.

New Hydro Rates

The Hydro-Electric Power Commission of Ontario has just issued a new schedule of rates which will go into operation November 1, 1912. These rates, be it understood, are what the municipalities pay to the Commission for energy at a voltage of 13,200 or 6,600 so that the expense of further reduction as well as distribution has to be borne by the municipality. The rates paid up to the present time as well as the new rates are given for 27 municipalities in the following list:

	Present Rates	New Rates
Baden	\$37.00	\$37.00
Beachville	33.89	32.00
Berlin	25.00	24.00
Brampton	29.00	29.00
Dundas	17.00	16.00
Galt	25.00	24.00
Guelph	25.00	23.50
Hamilton	17.00	16.50
Hespeler	26.00	25.00
Ingersoll	28.00	27.00
London	28.00	27.00
Mimico	30.74	30.00
Mitchell	38.00	38.00
New Hamburg	32.00	32.00
Norwich	30.00	30.00
Port Credit	36.79	32.00
Preston	25.00	23.50
Seaforth	41.00	41.00
St. Marys	38.00	35.00
Stratford	32.00	32.00
St. Thomas	32.00	32.00
Tillsonburg	32.00	32.00
Toronto	18.10	16.00
Waterdown	37.50	30.00
Waterloo	26.00	25.00
Weston	30.00	30.00
Woodstock	26.00	24.00

Lower Cable Rates

The following statement has been issued in London by the British Postmaster General with reference to the reductions made in their rates by the Western Telegraph Co. as the result of representations made by the Postmaster General and the Postmaster General of Canada:

The following reductions will be made on an early date, subsequently to be announced, in the rates for telegrams in plain language transmitted by that company and its associated companies between the United Kingdom and Canada and the United States. The present rate of 12 cents per word for telegrams subject to a possible delay of 24

hours will be reduced to 9 cents per word, and the telegrams will be transmitted and delivered subject only to such delay as is necessary to give priority to ordinary traffic at 24 1/3 cents per word. A new service of night letters will be brought into force at 73 cents for 12 words and 5 cents for each additional word. These telegrams will be delivered subject to the prior delivery of ordinary traffic on the morning of the day following that on which they are handed in. The present rate of \$1.46 for 30 words and 24 1/3 cents for each additional group of 5 words for week-end cable letters handed in up to Saturday night for delivery on the following Tuesday will be reduced to \$1.10 for 24 words and 5 cents for each additional word, and telegrams will be deliverable on the following Monday. A reduced rate of 7 cents, instead of 10 cents for ordinary press telegrams has already been brought into force, as also an improvement in conditions on which press telegrams at 5 cents per word are transmitted and delivered. The latter have hitherto been subject to a delay of 19 hours, reckoned by the clock time of the country of destination. They are now transmissible during hours from midnight to 6 a.m. in the country of origin, and also during hours from 6 to 9 p.m. Greenwich time, corresponding to 1 to 4 p.m. Montreal or New York time. These rates apply to those places in the east of Canada and the United States to which the rate for ordinary telegrams is 24 1/3 cents per word. Rates chargeable to other places, both in Canada and the United States, are being correspondingly reduced.

Canadian Society of Civil Engineers

The first meeting of the Canadian Society of Civil Engineers for the 1912-13 winter season was held in Montréal on October 10th. A paper was presented by Mr. F. H. Peters, A.M.Can.Soc.C.E., on the subject of Current Meter Testing. Mr. Peters described the current meter rating station at the Irrigation Office of the Department of the Interior of Alberta, the plans and specifications for which he originally prepared.

In the early part of 1909, the importance of taking accurate stream measurements was recognized by the Irrigation Office and a station was later established at Calgary at considerable expense. No stretch of still water of suitable dimensions was available, so a tank was built and the supply of water obtained from the city of Calgary. The paper points out that the main feature of the station is a car to which the current meter is attached and carried through the water in the tank at different uniform rates of speed. The three elements of distance, time, and number of revolutions of the meter are mechanically measured and from these the velocity of travel of the current meter through the water is related to the revolutions per second of the meter. This relation of revolutions to velocity constitutes the rating of the meter. The concrete tank is 250 ft. long with an inside width and depth of 6 ft. by 5 1/2 ft.

In the September issue of the Electrical News a descriptive article on the Mississippi River power development at Keokuk contained the statement that this work was in charge of the Stone & Webster Corporation. This was an error. All the engineering and construction work is under the direct supervision of Mr. Hugh L. Cooper, assisted by his own staff. Mr. Cooper and his organization bring to bear the advantages of many years of active and successful experience in this department of engineering work.

Please advise this office at once if your Electrical News does not reach you promptly.

The Makers of Electrical Canada—14

DUNCAN McDONALD—MANAGER-INVENTOR

From conductor to president sums up in a few words the career of Mr. Duncan McDonald, late general manager of the Montreal Tramway Company, and now president of the Montreal Terminal Company, Limited. With two or three interruptions Mr. McDonald has spent practically all his business life with the Montreal Tramways Company, has seen it pass from the old fashioned horse traction to the modern electric stage and has had a big share in building it up to its present prosperous condition, by adding extension after extension, or by absorbing, one after another, the smaller lines started to serve the outlying districts which now form a part of Greater Montreal.

Born in St. Thomas, Montmagny, P.Q., of Scottish descent, he was educated in Rimouski College, where he received a commercial education and learned a little of the classics. In 1881 he became a conductor on what is now the Montreal Tramways, but which then and for many years afterwards, employed the now out of date method of horse traction. Mr. McDonald went up through the various stages, becoming inspector and later assistant superintendent.

In 1890, when electrification was coming into vogue, Mr. McDonald resigned the position of assistant superintendent and went to the United States with the object of getting an insight into the electrical end of street railways. In the Twin Cities he served as motorman and in other ways learned the practical side of the business. Returning to Montreal in 1892, he obtained a position as inspector on the Montreal system, and afterwards was promoted to be superintendent.

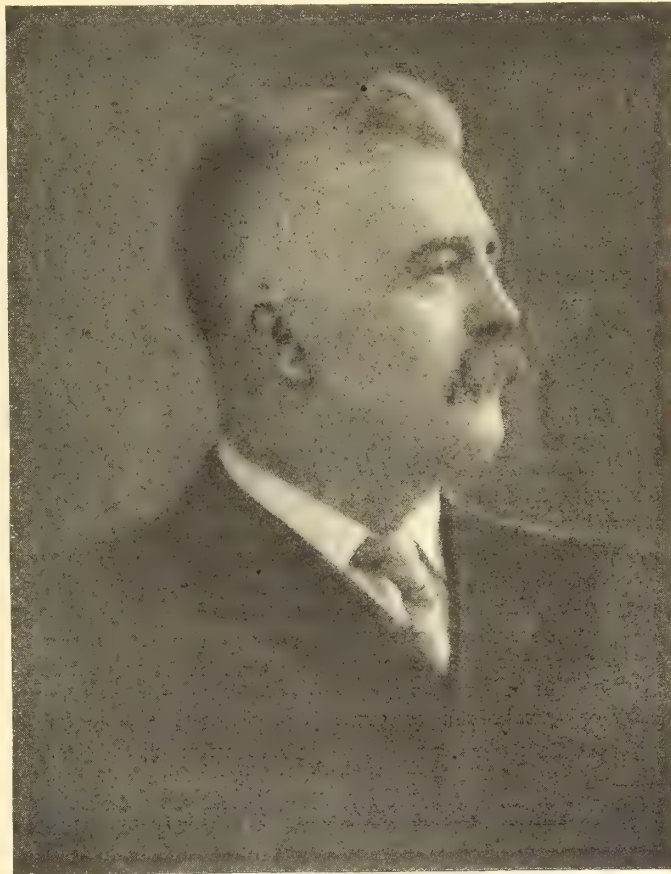
In 1892 the line passed over to the Forget syndicate and was electrified. Mr. McDonald remained with the company until 1900, when he went to Paris, France, as consulting expert and engineer to the General Traction Company, which controlled the subways and five hundred miles of surface track in and around Paris, as well as ten different systems in the provincial towns of France. In addition to being consulting engineer to the General Traction Company, he was managing director of the East Parisian Company, director of the North Parisian Company, and director of the Rivegauche Traction Company.

In 1894 the Montreal Street Railway Company asked him to return and manage their system, a position he accepted and occupied until recently, when he resigned to become president of the Montreal Tunnel Company. This con-

cern has for its object the construction of a subway under the St. Lawrence, connecting the north and south shores. The proposal is to build a double track through the tunnel for electric railway cars, both freight and passenger. All the railway companies in Montreal will be able to use these lines and develop business on the south shore. Mr. McDonald looks forward to the time when this side of the St. Lawrence will become densely populated, and believes the completion of this work will provide accommodation for a rapidly increasing population and for a large freight traffic which will follow.

Probably Mr. McDonald is best known as the inventor in 1905 of the pay-as-you-enter car. The first cars of this type were used in Montreal, then Chicago followed, next New York, and now the system is in use in nearly all the large cities on this continent. A company was formed to exploit the invention, a second company bought out the original rights, and now the p-a-y-e and the pay-within companies are merged into one concern, which also controls the stepless car. This company is known as the American Pay-As-You-Enter Co.

The p-a-y-e idea has also invaded Europe, and the International P-a-y-e Co. of London, Eng., of which Mr. McDonald is a director, is actively at work on the other side. At Gateshead, the cars are already in operation, and some cars are now being built for use on the system owned by the Aberdeen, Scotland, town council. It is also probable that the p-a-y-e system will be operated in London, for the London General Omnibus Com-



Mr. Duncan McDonald

pany are only waiting to see how it will work in connection with motor busses before deciding on its adoption. The p-a-y-e system undoubtedly introduces a plan of collecting fares which simplifies and ensures a full collection, and at the same time guarantees a more perfect control of the zones within which the cars operate.

The following officials of the Montreal Tramways Company, after visiting the convention of the Canadian Street Railway Association at London, Ont., went on to Chicago, where they were in attendance at the 31st annual convention of the American Electric Railway Convention, which closed on October 12th. Messrs. J. D. Evans, chief engineer; A. Gaboury, superintendent; H. E. Smith, comptroller; P. W. Dubee, secretary; D. Blair, superintendent of rolling stock; A. S. Byrd, superintendent of power plant.

What Canadian Railways Are Doing

Reports from Coast to Coast of Many New Systems with Added Mileage and Equipment for the Old — Activity Everywhere

British Columbia Electric Railway Company, Limited

The total miles of single track on September 1st, 1912, is 287.03. Of this 25.83 miles have been added during the year.

Plans are now being made for the construction of extensions in Point Grey and South Vancouver as well as additional lines for other parts of the company's system, full particulars of which cannot be given at this date.

From January 1st to September 1st, 1912, 25 city cars were added to rolling stock and placed in service. During the summer an order was placed for 24 interurban cars, delivery to be made this fall. Recently an order was placed at the company's car building plant at New Westminster for 15 city cars with date of delivery fixed at October 31st, and 20 city cars from the J. G. Brill Company with delivery on November 15th. This totals 84 cars added during the present year. The plans of the company for next year contemplate a purchase of 50 more cars for city lines.

Since January 1st a unit of 10,500 horse-power has been placed in service at the company's hydro-electric station on the north arm of Burrard Inlet and an addition of 7500 horse-power made to the steam auxiliary plant in Vancouver. Extensions to the company's power plants are now being pressed as follows:—No. 2 power house, on North Arm of Burrard Inlet; construction of building well advanced and contract awarded for three units of 14000 horse-power each, the first of which will be in operation about the end of the year. Jordan River plant on Vancouver Island: a unit of 6000 horse-power now in process of installation. Steam auxiliary plant on Vancouver Island; capacity 6000 horse-power—contract well advanced for building with equipment ready for installation as soon as structure is completed.

The position of the company with reference to power is described in a recent statement as follows:—

Mainland	
Lake Buntzen (hydro-electric)	
In operation	43,500 h.p.
In process of installation	42,000 h.p.
Vancouver (steam auxiliary)	20,000 h.p.
Vancouver Island	
Jordan River (hydro-electric) in operation	
In process of installation	6,000 h.p.
Goldstream (hydro-electric)	3,000 h.p.
Victoria (steam auxiliary)	1,500 h.p.
Saanich Peninsula (steam auxiliary)	
In process of installation	6,000 h.p.
Total	128,000 h.p.

The Jordan River generating station is planned to provide a possible output of 36,000 h.p. through the installation of additional units, as may be demanded.

In addition to the above the company has well-developed plans for the establishment of hydro-electric generating stations on the Lillooet River and in connection with Jones and Chilliwack Lakes, all these points being on the mainland. With the carrying out of these plans the total possible output will be over 200,000 h.p.

Recent additions have been made to the sub-station equipment in Vancouver as follows:—One 2,000 kw. rotary converter and one 1500 synchronous motor-generator and one 1200 synchronous motor-generator. At Earls Road in South Vancouver a new sub-station has been erected at the

cost of \$125,000 with complete equipment, which includes three 3000 kv.a. step down transformers and six 1000 kv.a. step down transformers.

The remodelling of the Vancouver sub-station on Main street is now in progress and the capacity of the plant will be greatly increased when this work is completed. All over the company's system, improvements of a minor character have been made to the sub-stations during the year, the capacity thus being greatly enlarged to meet the growing demands. Plans are being considered by the company for the erection of several additional sub-stations.

City of Toronto Lines

Following the failure of the Toronto Railway Company to complete and operate lines along certain streets set out by the city council, the city has itself undertaken the construction of the roadway and at the present time has made considerable progress towards the completion of some



Track laying on St. Clair Ave., Toronto

nine or ten miles of line. On Gerrard street east from Greenwood avenue to Main street, a distance of $2\frac{1}{2}$ miles, the roadway is practically complete. On Danforth avenue from Broadview to Greenwood avenue and from Greenwood to the eastern city limits a distance altogether of about $3\frac{1}{2}$ miles, the work is probably about one-half completed. On St. Clair avenue ties and rails have been placed practically all the way from Yonge street west to the G. T. R. tracks near Davenport station, a distance of about 3 miles. St. Clair avenue is being widened and the rails placed in the centre of the avenue leaving ample space on each side for vehicular traffic. Trolley wires will be suspended from one single pole placed between the two car lines. The photograph shown herewith indicates the stage to which the work has advanced on St. Clair avenue. Tracks are lifted with a hand jack and gravel is tamped down under the ties to level the road bed. A six inch lift of gravel is then put in between the ties and broken stone placed on top of the gravel and ties to the top of the rails, after which this stone is covered with cement. On both St. Clair and Gerrard streets, 80 lb. T rails are being used while on the Danforth avenue line, 90 lb. Girder rails are being installed.

The question has not yet been decided how these lines will be operated. It had been hoped that an agreement could be reached with the Toronto Railway Co. but failing

this, it appears to be the present intention to operate the Gerrard street line, the first to be completed, with a gas-electric or some similar service until such time as a permanent equipment can be installed.

Lethbridge Railway System

The system was installed and is being operated by the city of Lethbridge under the management of superintendent Arthur Reid. Eleven miles of track are already laid and were opened for service on September 13th, 1912. An extension of four miles will likely be added next year to round out the system. The present rolling stock consists of five double truck cars and five single truck cars manu-



Car Interior on the new Lethbridge System

factured by the Preston Car & Coach Co. These cars are illustrated herewith.

The power equipment consists of one 400 kw. and one 200 kw. synchronous motor-generator set with switchboard attachments, operated from a 1500 kv.a., high pressure steam turbine generator. In the near future the rolling stock will be supplemented by three more double truck cars.

The rolling stock for the municipality of the city of Lethbridge is being supplied by the Preston Car & Coach Company. The single truck cars are 21 feet bodies with p.a.y.e. platform. In the accompanying photographs an exterior and interior of this type is shown. The length of the

front platform is 4 ft. 6 in.; length of rear platform 6 ft. 6 in.; width of body over sheathing 8 ft. 2 in. The bottom frame is the Preston Car & Coach Company's standard steel under frame. The bodies are mounted on Taylor extra heavy trucks with rolled steel wheels, equipped with Westinghouse 101 B-2 motors and K-10 controllers and are finished inside and outside in natural cherry. The seats are upholstered in woven rattan. Floors are covered with flexible steel matting. The electric bell system is that known as the Consolidated Buzzer System.

The deck sash do not swing as is usual in street cars of this description, but each car is equipped with four automatic ventilators. The fenders used are the Providence type A. Snow scrapers are the Root No. 2. Curtains on side windows are pantasote. The lower panels in the vestibule doors are made of clear plate glass three-eighths of an inch thick. This is in order that the motorman and conductor will have an unobstructed view of the steps and has been found to be an important factor in preventing accidents.

The double truck cars are of exactly the same construction as the single truck cars described above, with the exception that there are six automatic ventilators in each car instead of four, and that they are mounted on Brill 27-G-I trucks and have K-6 controllers.

Edmonton Radial Railway

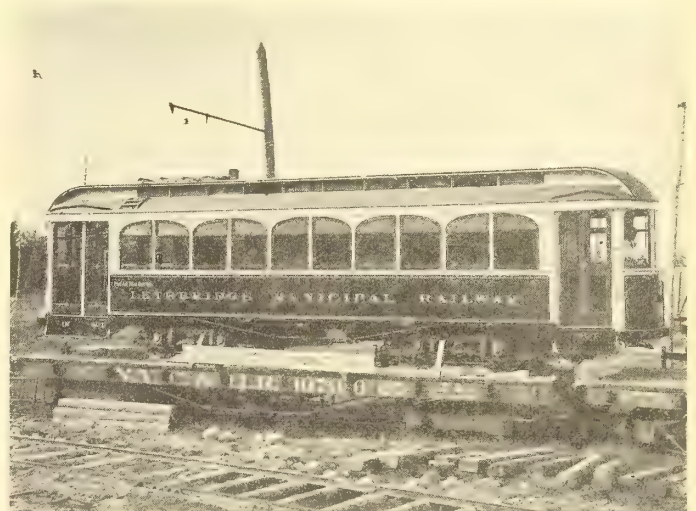
This line now operates 30 miles of track, 2 having been added during the present year. It is expected that 20 more will be added next year. During the past year 15 passenger cars and one work car have been added to rolling stock. Generating equipment during the year has been increased by one 500 kw. motor-generator set.

Extensive plans have been laid for the further equipment of this system and 35 passenger cars of which the motors and trucks are already ordered will be added to rolling stock. Other requirements will be 4 ballast cars, one line car, which will be built in the shops of the railway department of the city, and one 5000 gallon sprinkler car. Two more 500 kw. motor-generator sets will also be purchased.

Work at present in progress includes permanent double track on Syndicate avenue, from Jasper avenue to Norwood Boulevard; permanent double track on 5th street east from Whyte avenue to Saskatchewan avenue; ballasted double track on 5th street west from Whyte avenue to High Level bridge and ballasted single track on Whyte avenue west from 5th street east to 11th street east and 1800 ft. on 11th street east. A new car barn is being built on the north



Single truck p. a. y. e. Cars—Lethbridge



Double Truck p. a. y. e. Cars—Lethbridge

side and extensions are being made to the barn on the south side.

Mr. W. T. Woodroffe, formerly with the B.C.E.R. Co. and later city electrician of Vancouver, was recently appointed superintendent of the Edmonton Street Railway System.

Mayor George S. Armstrong of Edmonton announced in an interview a few days ago, that the municipality, which owns and operates the street car lines in Edmonton, is planning to extend its western line to St. Albert next year, going by way of Calder and the MacArthur terminal and that a right-of-way has been secured. The city of Edmonton received a charter from the provincial government of Alberta some years ago, granting privileges to build interurban railways to various parts of central Alberta. The city has done some grade work on the proposed line to St. Albert, but no attempt has been made to secure right-of-way or survey a line in other parts of the district. The charter will expire some time next year. It is likely that efforts will be made to have the next legislature extend the time. There is a movement in the city council to square the boundaries of Edmonton, after which there will be no more extensions. When this is done, as it will be in a short time, the distance from the boundary to St. Albert will be about two miles.

Edmonton Interurban Railway Co.

Official announcement is made by M. Kimpe, managing director, that the Edmonton Interurban Railway Company, incorporated in 1910 and reorganized on September 16 last, will build 300 miles of electric lines to connect Edmonton with numerous towns in central Alberta. J. W. McLeod, contractor for construction, has 150 men on the grade for the first unit of six miles, from the northwestern city limits to St. Albert, where a power house, with sufficient capacity to operate 26 miles of line, will be erected. Steel will be laid the coming winter and it is planned to have the line in operation early next June.

The proposed initial equipment for the Edmonton-St. Albert line will be 12 60-passenger coaches, with express parcel and baggage compartments, and 50 freight and coal cars. The passenger cars will be of the latest approved type. It is planned to make the trip to St. Albert in 20 minutes, allowing for stops at several points. The franchise granted by the town of St. Albert provides that the local line shall be built first. Spur tracks will be extended from St. Albert to the Acme Brick Company's plant, a half mile, also to St. Albert colliery, the output of which is marketed in Edmonton.

Under the charter the company has power to build lines east, west, north and south of Edmonton, and it is said to be the intention to proceed with the work regardless of what course the city of Edmonton may follow under its charter. Other lines projected, upon which work will probably begin early next year, are: Edmonton to Beaver Lake and Tofield, 40 miles; Edmonton to Pigeon Lake, 40 miles; Edmonton to Vegreville, 60 miles; Edmonton to Namyoy, 12 miles, and a line from Edmonton to Morinville by way of St. Albert, 18 miles; Edmonton to Lac Ste. Anne, 56 miles; Edmonton to Mewasson, 45 miles.

These units will tap rich grain and dairy districts, coal mines, asphalt, gravel and deposits of brick, concrete and other manufacturing plants in various parts of central Alberta.

Cornwall Street Railway Light and Power Co.

This company operates six miles of line in Cornwall, Ontario. No additions to equipment have recently been necessary.

Montreal Tramways Co.

This system now comprises 236 miles of single track having been increased by 5.39 miles during the year. A number of extensions are being planned but nothing has yet been decided. During the year, one hundred steel cars were added to the rolling stock. The power supply to the Montreal Tramway System is sent out from six sub-stations advantageously placed at as many points throughout the city.

In the William street station there are steam driven units as follows: One 1500 kw., two 850 kw., six 300 kw. and eight 200 kw. units; also four 250 kw. boosters. There is also a 500 kw. synchronous motor driven unit and six 500 kw. induction motor driven units operated from hydro-electric lines.

The Hochelaga station contains only steam driven units, two of 1000 kw. capacity and one of 2000 kw.

The St. Henri sub-station contains three 500 kw. induction motor driven units supplemented by a 1400 ampere storage battery.

The St. Denis sub-station contains four 500 kw. induction motor generator sets supplemented by a 1400 ampere storage battery.

The Cote St. Paul station contains one 1200 kw. synchronous motor generator.

The Shawinigan sub-station contains three 1000 kw., 30 cycle, rotary converters and a 1400 ampere storage battery.

Mr. Duncan McDonald formerly general manager of this company recently resigned to devote his attention to the Montreal Tunnel Co., and was succeeded by Major J. E. Hutcheson of Ottawa.

Ottawa Electric Railway Co.

Trackage is being extended in Ottawa to serve expansion in population which is rapidly taking place, and four miles will be completed as quickly as possible, which will bring the total up to about fifty-two miles. Recent additions to equipment include 18 double truck, 45½ ft. p.a.y.e. cars and a double truck air-brake sweeper furnished by the Ottawa Car Co. The power equipment has also been added to by one 1500 kw., d.c. water driven type Westinghouse generator. This generator is operated by four turbine water wheels controlled by Lombard governor. It is also the further intention of this company to add to their steam power generating equipment. A new car barn will also be built and equipment already on order in the way of rolling stock includes 10 double truck, 45¼ ft. steel frame p.a.y.e. cars. There is also under construction at the present time a sub-station with equipment of 650 kw. motor-generator.

Mr. J. E. Hutcheson, for many years superintendent of this road, was recently appointed general manager of the Montreal Tramways Co. He is succeeded in the Ottawa office by Mr. F. D. Burpee formerly assistant superintendent.

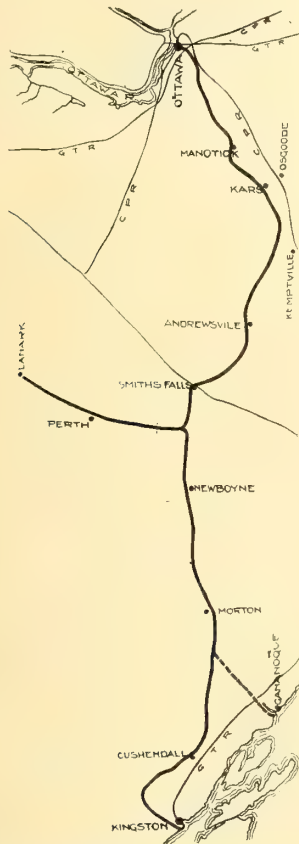
Toronto Eastern Railway

This line, when completed will connect Toronto with Bowmanville. At the present time 25 miles of the road have been graded and the remaining 20 will be proceeded with as rapidly as possible. It is hoped that the road will be in operation by August 1913. If traffic conditions warrant it, extension will later be made to Cobourg. No equipment has been ordered as yet, but orders will be placed in the near future for rolling stock and substation requirements. It has not been decided what type of car will be used.

The line is being built and will operate under the general management of Mr. J. C. Rothery. Mr. E. W. Oliver is chief engineer.

Ottawa, Rideau and Kingston Railway Co.

The accompanying map indicates in a general way, the course to be followed by this road. The main-line extends from Ottawa to Kingston and will therefore serve the following cities and towns: Ottawa, Moonéy's Bay, Manotick, Kars, North Gower, Carsonby, Becket's Landing, Burditts Rapids, Andrews ville, Merrickville, Kilmarnock, Smith's Falls, Lombardy, Newboyne, Portland, Forfar, Elgin, Morton, Seeley's Bay, Brewers Mills, Washburn, Cushendall and Kingston on the main line, and on the branch leaving the



Route Map of Ottawa, Rideau Lakes and Kingston Railway

main line at or near Lombardy, thence to Rideau Ferry, Elmsby, Perth, Balderson and Lanark.

The company are also considering a proposition to build as per the dotted line from Seeley's Bay to Gananoque. The present line as surveyed covers 127 miles. The additional line to Gananoque would increase it to 140 miles. The company have entered into an agreement with an English syndicate for the financing, construction and equipment of the entire 127 miles and the general manager of the road, Mr. U. L. Upson, is now on his way to England with maps, plans and profiles, when the details as to construction, etc., will be fully determined by the engineers in London.

It is the intention of the English syndicate to commence at once such construction work as can be carried forward during the winter, such as rock work and other special work, in order that they may rush construction along the various lines in the spring. The line is to be built on standard steam principles with 80 pound steel rails and bridges of standard C. P. R. type, thus enabling the running and handling of either steam or electric locomotives or trains over the entire line. Much pains has been taken in the survey work to enable the company to secure easy grades and curves with the result that there will be no grade greater than 6/10 of 1 per cent. and no curves sharper than 6 degrees.

The water powers in the immediate neighborhood are numerous including two on the Ottawa river, at Britannia 4000 h.p. and at Fitzroy Harbor, 100,000 h.p. On the Madawaska at Stewartville there is 10,000 h.p. and at High Falls, 20,000 h.p. On the Outlet at White Lake, 600 h.p. and at Iroquois, 600 h.p. On the St. Lawrence, 2000 h.p. at Morrisburg and 1500 h.p. at Mille Roches. The present intention however, is to use the gasoline electric car on account of the considerable length of the road and the probable long distance between stops.

The engineers' estimate of the cost of this railway is placed at \$3,094,000, forty miles being estimated at \$13,000 per mile and 234 miles at \$11,000 per mile.

Ottawa and St. Lawrence Electric Railway

This is an amalgamation of the North Lanark and the Ottawa and St. Lawrence electric railways both holding provincial charters for the construction of some 274 miles of line in the Ottawa district as shown by the accompanying map. The territory proposed to be covered extends from Ottawa west along the south shore of the Ottawa river to Arnprior and Braeside thence south via White Lake, Lanark, Perth and Athens to a point on the St. Lawrence River 8 miles west of the city of Brockville, thence east following the north shore of the St. Lawrence to the boundary between Ontario and Quebec provinces. From Ottawa south via Metcalfe, Vernon, Ormone, Winchester, and Winchester Springs to Morrisburg, connecting with the St. Lawrence River line, a 4 mile branch Kenmore to Russell and a branch from the Arnprior-Lanark line (crossing the narrows of White Lake) to High Falls on the Madawaska River 20 miles. There are no engineering difficulties in the total mileage; seventy-five per cent. of the grading will be over cultivated farms, much of it a dead level.

The principal cities and towns passed through, with



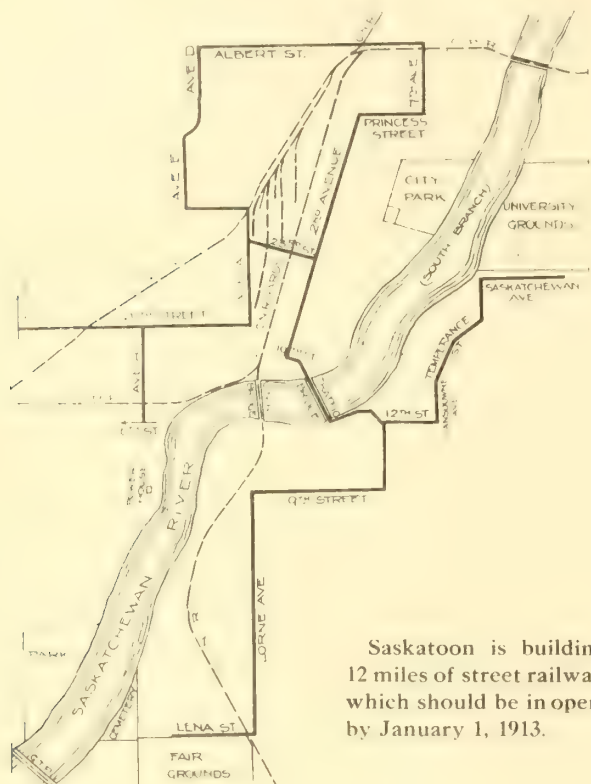
Route Map of Ottawa and St. Lawrence Electric Railway

their population, will include the following: Ottawa and Hull 100,000, Arnprior 5,000, Lanark 1,200, Perth 5,000, Athens 1,600, Brockville 11,000, Prescott 4,500, Cardinal 1,500, Iroquois 1,200, Morrisburg 2,000, Cornwall 9,000, Lancaster 1,000, Winchester 1,800, Kenmore 500, Metcalfe 800, Russell 500.

The control of the Halifax Tramway Company has passed into the hands of Montreal capitalists at the head of whom is Mr. Roberts of the Montreal Tramways Co. These capitalists also control the Nova Scotia Power Co. and were developing a power proposition on the Gaspereaux river but owing to considerable opposition in the Local House last session to the Tramway Bill, work on this was stopped. We understand that work on this undertaking will now be pushed to completion.

Saskatoon Railway System

The accompanying map will give a general idea of the lay-out of the new railway system in the city of Saskatoon. The system will consist of 12 miles of track and it will be seen that the belt line idea is being utilized. The system is being constructed by the Stone & Webster Corporation of Boston, under the direct supervision of Mr. Town-



send as local manager. It is the intention of the city to take over the system from the corporation at an early date. Operation is expected to begin not later than the new year.

Moncton Tramways, Electricity and Gas Co.

This company operates four miles of single track, two of which have been added during the year. It is proposed to further extend the lines to $5\frac{1}{2}$ miles next year. Recent equipment added to rolling stock consists of two single truck cars, one trailer and one work car and further equipment to the extent of one double truck convertible car and two single truck convertible cars will be required in the near future. At present extensions are under way on the completion of the city loop line and on the line to the I. C. R. new shops, the latter of which will be in operation by the first of November. Mr. Harold N. Price is superintendent of tramways and electricity.

The Moncton Tramways Co. of Moncton, N.B., are now operating their cars over a section of the Moncton & Buctouche steam railway line. This company are planning considerable extensions during the spring of 1913 and will buy more cars and equipment. They are using as fuel natural gas obtained from the Maritime Oil & Gas Co. whose wells are located some eight miles from Moncton. This company propose installing gas engines shortly.

Three Rivers Electric Railway

It is now announced that the Three Rivers Electric Railway Co. will not proceed this fall with the construction of their line.

Picton County Electric Company

The Picton County Electric Co. with head office at Stellerton, N.S., are making an addition to their car line in order to connect with the Eastern Car Company's plant at Trenton. When completed it is the intention of the company to operate a fifteen minute service on the New Glasgow, Trenton section. This tramway connects the four towns of Westville, Stellerton, New Glasgow and Trenton, 36 foot double truck cars with single motor equipment being used. These cars are fitted with G. E. 67 motors and K 10 controllers, also air brakes. This company, formerly the Egerton Tramway Co., in 1909 bought out the New Glasgow Electric Co. and installed a modern generating plant at Stellerton from which they now operate both car lines and also the power and lighting systems for the four towns. The plant at present comprises 125 kv.a. and one 150 kv.a. railway generators, and one 50 kv.a., one 300 kv.a. and one 200 kv.a., 3 phase, 60 cycle, 2300 volt generators. These generators are all direct connected to high speed condensing engines. The boiler plant, formerly equipped with induced draft, is now operating with natural draft. This plant adjoins the Acadia Coal Co., which materially reduces the cost of fuel. The general superintendent of this company is Mr. L. T. Flaherty to whom no small amount of the success and advancement of the company is due.

Cape Breton Electric Company

The Cape Breton Electric Company, Limited, is a Stone & Webster property. Part of the mileage is composed of local lines in the city of Sydney, an inter-urban between North Sydney and Sydney Mines, and the track of the Sydney & Glace Bay Railway Company, an interurban operating between Sydney and the colliery district around Glace Bay under a ninety-nine year lease. The company does the entire light and power business in Sydney and North Sydney and operates three ferry boats between these two places.

Mr. H. C. Foss, the former manager of this company, has been succeeded by Mr. E. L. Milliken, formerly superintendent of light and power, who has been succeeded in turn by Mr. W. M. B. McDonald. Mr. J. A. Sharpe has been appointed master mechanic succeeding Mr. H. H. Archibald. No additions have been made to trackage during the year, which still stands at 31.5 miles. A 500 kw. Allis-Chalmers turbine with barometric condenser and complete auxiliaries has just been installed and two sub-station equipments of capacities 100 and 150 kw. respectively for mine operation. These supply two phase, 220 volt power from the three phase, 22,000 volt transmission line. One new double truck, air operated snow plough will be put in service this winter.

The Cape Breton Electric Co. of Sydney, N.S., are planning an extension to their tram lines to New Waterford about eight miles, also some changes to their sub-station at Glace Bay where they will likely install a motor generator set.

St. John Railway Co.

The St. John Railway Co. has begun active preparations on the extension of their line to Cane's corner. This company operates $12\frac{1}{2}$ miles of line in the city of St. John.

The St. John, N.B., Railway Co. lately submitted a schedule of reduced rates for power, and it has been approved by the Public Utilities Commission of the province. As a result the company will spend nearly \$50,000 in enlarging the equipment of its power house, anticipating an increased demand from manufacturers for the cheaper power. The company will also extend its line part of the way to East St. John before winter sets in.

The Oshawa Railway Co.

Between fourteen and fifteen miles of track are operated by this company, one of which has been added during the past year. Plans are prepared for the addition of two or three miles next year. Recent equipment added to the system includes two convertible passenger cars, two new freight motors, one sweeper and one baggage car. New power equipment which is just being installed, will consist of one 300 kw. Westinghouse motor generator set which will be operated from the lines of The Electric Power Co. The new car barn, replacing the one destroyed recently by fire, has just been completed, including the motor generator building which is attached, and renewal work on the tracks along the main streets of Oshawa as well as the installation of several new sidings is at present under way. In the near future it is likely one or two more passenger cars will be required and possibly another 300 kw. motor generator set.

Port Arthur and Fort William Railway Co.

This line is jointly owned by the cities of Port Arthur and Fort William, which are also connected by a short inter-urban line, part of the same system. Additions to the extent of $3\frac{1}{2}$ miles have been made during the present year, bringing the total up to 25 miles and several miles are projected for next year including belt line in Port Arthur, $4\frac{1}{2}$ miles; an extension in the east of Port Arthur, $1\frac{1}{2}$ miles; belt line in Fort William, $2\frac{1}{2}$ miles. The Ottawa Car Co. have recently supplied the twin cities with two single truck double end control cars; one double truck, double end control car; and two double truck, single end control cars. Four trailer cars will be added in the immediate future. Sub-station equipment is on order by Port Arthur of a 500 kw. motor generator set. Mr. M. O. Robinson is general manager of the whole system.

The Regina Street Railway System

Comprehensive plans are prepared for doubling the trackage of the system during the next year. At present $12\frac{1}{2}$ miles are in operation, 2 miles of which were added during the past year, the original system of $10\frac{1}{2}$ miles having been placed in operation first during the summer of 1910. Next year it is proposed to add from 14 to 16 miles. Recent additions to rolling stock include six cars with eight more on order, and power equipment additions include two 400 kw. d.c. machines. A 1500 kw. unit will be added in the near future and sixteen more cars will be added to rolling stock. Mr. H. Doughty has returned to Regina as superintendent after an absence of some months during which he was superintending the installation of the Lethbridge Municipal system.

Niagara, Welland and Lake Erie Railway Co.

Only three miles of track are yet in operation, the system having been started up for the first time during the present year. It is the intention to extend the line by another five miles next year. Rolling stock at present consists of three passenger cars and three more will be required. The power is obtained from the Ontario Power Co. through a motor-generator supplying current at 550 volts. The company has been held up by the town paving and so has been unable to carry on the extensions as rapidly as would otherwise have been the case, but at the present time there is under construction two miles of line on which 70 lb. rails are being used. Mr. C. J. Laughlin is managing director of the company and Mr. T. F. Swayze, superintendent.

Calgary Municipal Railway System

This line now comprises 58 miles of single track. The growth of Calgary is evidenced by the fact that 17 miles have been added during the present year and 10 more will be added next year. Rolling stock has been increased during the year by twelve 41 ft. cars, one sprinkler and one scenic car. The total rolling stock now comprises eighteen 32 ft. single truck cars, nine 46 ft. double truck cars and twenty-one 41 ft. double truck cars, all closed. To serve the increased mileage, eighteen new motor cars 41 ft. type, will be added and six double truck trailers. At the present time the work under construction is a two mile track extension and additions to the car barns.

Montreal and Southern Counties Railway

At the present time this system consists of 9.1 miles of single track, 1.3 of which have been added during 1912, but in all probability, about 50 miles will be added next year and work is at present in progress on single track lines connecting St. Lambert with Richelieu and with La Prairie. In connection with these extensions, an order has been placed with the Ottawa Car Co. for six passenger and two combination passenger and baggage cars, also a double truck sweeper, all for delivery this autumn. Another rotary plough has also been purchased. It will further be necessary to install two complete sub-station equipments in connection with the projected line extensions.

The London Street Railway Co.

Extensions to trackage are under way which will bring the total mileage up to 35. These extensions include 6000 ft. at Cheapside and William streets in the north end of the city and some double tracking in the south end, making in all about two miles. Five or six single truck cars will be required in the near future. It has not yet been decided what course will be followed with regard to power equipment. Negotiations have been carried on with the Hydro-electric Power Commission but so far the Commission's price has not been satisfactory to the company. In the event of no agreement being reached, the company may install additional steam equipment.

Toronto Suburban Railway Co.

This company now operates eleven miles of railway track and expects to complete twenty-five more during the next year. The extensions at present under way are from Weston to Woodbridge, a distance of eight miles, and from Lambton Mills to Guelph, a distance of fifty miles. Grading on both of these extensions has been going forward for some months. This company has recently added two double truck interurban cars to its equipment and will require several more of the same type to operate their extensions. Rotary converters and switching gear will also be required at various points along the line.

Sarnia Street Railway Co.

This company has been unfortunate in the loss of its equipment by a disastrous fire. Service was maintained for some time by equipment obtained from the D. U. R. Co. but the new motor generators are now in operation, consisting of one 300 kw. and one 150 kw. Swedish General Electric type equipment, supplied by Messrs. Kilmer, Pullen & Burnham. $9\frac{1}{4}$ miles of track are operated. The former manager and secretary of the road, Mr. H. W. Mills, died on June 6th and was succeeded in these offices by Mr. G. E. Wadland.

Niagara, St. Catharines and Toronto Railway Co.

This company operates 58.2 miles of trackage in the Niagara peninsula under the management of Mr. E. F. Sixas. They have recently added two electric engines and four semi-convertible double truck Brill passenger cars to their rolling stock which will be further supplemented by another half dozen interurban passenger cars in the near future.

A number of short track extensions are at present under way to serve various manufacturing interests operating close to the line. These include sidings to the Montrose Paper Mill and to the Thorold Pulp Co. both of Thorold; a siding to the Interlake Tissue Mills, Merritton; a siding to the Canadian Warren Axe & Tool Co., St. Catharines, to the Metals Chemical Co., Welland, and to the Dominion Cannery, Limited, Fonthill. Surveys have also been made for an extension of the line from St. Catharines to Niagara-on-the-Lake and work will probably be commenced this autumn.

Moose Jaw Electric Railway Co.

The original eight miles of track are being extended and increased to eleven. Rolling stock has been recently increased by the addition of three p.a.y.e. single Brill truck cars and more cars will be required in the immediate future. The power equipment consists of a Diesel oil engine plant which is being supplemented by another 500 kw. engine of the same type now on order from the Mirrlees, Bickerton and Day Co. of Stockport, Eng. The car barn capacity has already been found insufficient and at the present time is being doubled to accommodate thirty-four cars. The officials of the Moose Jaw Railway Co. are A. H. Dion, superintendent; C. E. McGee, accountant; R. W. Moore, master mechanic; Geo. Connor, engineer-in-charge of power house; F. S. Wright, inspector.

Quebec Railway Light, Heat and Power Co.

The city division comprises 22.49 miles, .667 of which was added during the present year in Limoilou ward. Another double truck observation car has been added to rolling stock; this car is similar to the one described a few months ago in the Electrical News. There is also on order with the Ottawa Car Co. two double truck, 40 ft. p.a.y.e. cars. Further extensions in Limoilou ward are at present in progress to the extent of 1 1/3 miles. Mr. R. M. Reade was recently appointed superintendent of this division succeeding Mr. McDonald, and Mr. Eyre Turbett has been appointed master mechanic.

On the Montmorency division of this system, three miles have been added during the year, bringing the total trackage up to 28.

Simcoe Railway and Power Co.

Contrary to reports, no work is being done on this line during 1912, but it is hoped that next summer will see the construction under way. The plans call for an electric railway from Penetang through Midland and Port McNicholl to Victoria Harbor, and later it is intended to extend easterly to Waubaushene and Coldwater. At the present time, this company are occupied in the construction of a duplicate transmission line between their power plant and Waubaushene, which will be necessary to supply power to the Ontario Hydro-electric Power Commission.

Toronto Railway Company

The Toronto Railway Company are re-laying tracks at various points following their standard construction methods.

The work is divided between the city authorities and the company, the city preparing the roadbed and the company laying the rails. The roadbed is first excavated to a depth of 19 inches and the first 6 inches filled in with 1:2:3 concrete. The next 6 inches is occupied by the ties embedded in concrete. The upper 7 inches holds the 7-in. steel rails, the space between which, and on each side, is filled in with paving stones. Above the stones a thin layer of one to one cement is placed. When completed the space between the rails is level and at the same height as the top of the rails.

Winnipeg Electric Railway

The number of miles operated is 78.4, of which 9 have been added this year and to which 10 more will be added during the next year. To rolling stock has been added 40 city cars with Brill trucks and C. G. E. air brakes, 2 sweepers and one city sprinkler. Power equipment has been increased by a 12,000 kw. stand-by steam turbine plant. The additions made to substation equipment comprise 2 transformer substations with 1500 kw. capacity, 2,200 to 13,200 volts; one railway sub-station 1400 kw. capacity, one railway substation 1400 kw. capacity and one railway substation addition of 1200 kw. capacity.

Winnipeg, Selkirk and Lake Winnipeg Railway

This is a subsidiary of the W.E.R. Co. operating 21 1/2 miles. Next year the branch to Stonewall, a distance of 20 miles is expected to be completed. Equipment added during the year includes two motor cars, one trailer, two 550 kw. 600 volts motor-generator sets and three 350 kw., 2200 to 13,200 volt transformers. Another 500 kw. motor-generator set will be required for a new railway substation to be built on the Stonewall line. Following the recent decision of the Utilities Commission extensive terminals will be built as soon as possible at the entrance of this line to the city of Winnipeg.

Halifax Electric Tramway Co.

The total number of miles now operated is 19.16, 4 1/4 of which have been added during the present year. 3/4 of a mile will be added next year. Four cars have been added to the rolling stock and the power equipment is being increased by a 2000 kw. C. G. E. steam turbine which will operate three 600 kw., d.c. generators. At the present time a new brick car barn 70 ft. by 90 ft. is in process of erection. Four more open cars will be added to next year's rolling stock. This system has recently been taken over by interests closely associated with the Montreal Tramways Co.

London and Lake Erie Transportation Co.

New shops are under construction for this company in St. Thomas to accommodate seventeen 50 ft. cars. The new sub-station and freight sheds are also being built at the same place and extensive ballasting at different points along the twenty-nine miles comprising this system is being done. Recent additions to the rolling stock include two 4 motor passenger cars, two trailer passenger cars and one baggage car.

Niagara Falls, Park & River Railway

This is a division of the International Railway Co. including 25 miles of line operated in and around Niagara Falls, Ont. The equipment consists of nine closed and twenty open cars, operated by a 2000 horse power water power plant situated in the immediate vicinity of the Falls.

Dominion Power and Transmission Co.

The lines of this company total 107.67 miles. No additions have been made during the past year, though these have been under discussion for some time. The city is anxious for extensions in Hamilton but under conditions which do not appeal to the company. Large additions are being made to rolling stock including three new interurban cars already added this year to be supplemented by a dozen 21 ft. single truck cars now on order with the Preston Car & Coach Co.

Hull Electric Railway

One and a half miles of track have been added during the year, bringing the total up to 27.66 miles. Additions to rolling stock include six p.a.y.e. double truck semi-convertible cars. The substation at Aylmer has been completed and a 250 kw. induction motor generator set installed. A similar set has also been added at the Hull sub-station. At the present time the company has under way the construction of a car shed with capacity for twenty-seven single truck cars.

Humber Valley Railway Co.

Negotiations have been carried on for some time between one or two private individuals and the city council with a view to having the city undertake the construction of an electric railway along the Humber river valley. This district is being exploited as a fine residential area and it is probable that if the city does not see its way to install a railway system, real estate interests may find it necessary to do so.

The Levis County Railway

A quarter mile of track has been added during the present year and plans are out for another mile and one half in the near future, which will bring the total up to about twelve miles. These extensions, which are at present well under way, will connect the St. Romuald terminus with Garnau's bridge, a distance of 1½ miles. A fourteen bench open car was recently added to the rolling stock and a single truck rotary snow plough will be required for the coming season.

Toronto Railway Co.

The number of miles of single track of the Toronto Railway Co. is now approximately 120, to which about 10 have been added during the year. The company suffered a very severe loss during the early summer when a large number of their open cars were destroyed by fire. Their car-building department has however, been operating at full capacity all summer and about 110 cars have been turned out during the last year.

Windsor, Essex and Lake Shore Rapid Railway Co.

No additions have been made to the trackage on this system during the year, which still stands at 36.61 miles. Rolling stock equipment has been increased however, by one combination electric locomotive and express car operated by four 100 h.p. a.c. Westinghouse motors. Rolling stock will be further supplemented in the near future by one passenger car, two box cars and four freight cars.

Suburban Rapid Transit Co.

This is a subsidiary of the Winnipeg Electric Railway Co., operating 19.6 miles of road. The substation equipment added during the year is a 1200 kw. motor-generator set and auxiliaries.

Yarmouth Street Railway Co.

This system comprises three miles of single track which will be increased by ¼ of a mile next year. Considerable new equipment has also been ordered, including two box cars, a pair of 500 h.p. turbine wheels, a 125 h.p. boiler, a 100 kw., a.c., generator and a 175 h.p. induction motor. At the present time, two miles of 45 lb. rails are being renewed with 60 lb. rails.

Medicine Hat Railway System

Following the submission of a proposition to build a street railway in Medicine Hat, a by-law will be submitted, giving the council power to close with a company which is controlled by Sir Max Aitken. This company is offering the city a liberal proposition, being anxious for the railway on account of their own financial, manufacturing and land interests. In all probability the franchise will be granted.

Galt, Preston and Hespeler Railway Co.

This company operates 22 miles of track, 1½ miles of which have been added this summer. Recent additions to rolling stock consist of two 55 ft. passenger cars. There are at present, in progress, the installation of a new freight shed and yards at both Berlin and Preston. The use on this road of gas-electric cars is being considered but has not yet been decided.

Berlin and Waterloo Street Railway

This line is operated by the municipality of Berlin and consists of 5½ miles of track, including leased lines. During the past year, increase has been made in their car barn capacity to the extent of a 46 ft. x 74 ft. addition. The rolling stock is also being added to, an order having been already placed for November delivery for two 50 ft., steel under-frame, semi-convertible cars.

Stratford Railway Co.

Negotiations are still in progress between Sir Wm. MacKenzie interests and the city of Stratford looking to the conclusion of an agreement by which the former will construct a street railway to serve the city. The company is seeking a 25 year franchise and it is believed that an agreement will eventually be reached.

The International Transit Co.

This company operates 3.7 miles of track in Sault Ste. Marie. In all probability, additions will be made to the line during the next year, but this has not yet been decided. The company will be in the market in the near future for an addition to their rolling stock of three motor cars.

Nelson Railway System

This line is controlled by a number of citizens who formerly took it over from the municipality rather than have its operation cease when it was showing a considerable loss. Negotiations have recently been under way looking to a re-purchase of the line for the city. The hilly nature of the district covered, renders the operation of the street cars somewhat difficult.

Chatham, Wallaceburg and Lake Erie

40 miles of track are operated. The rolling stock consists of seven double truck passenger cars, three electric locomotives, seventeen gondola and three box cars, and two passenger double truck trailers. The electric equipment consists of two 300 kw. generators supplemented by

a Gould storage battery plant. This company will require sub-station equipment in the near future.

Sandwich, Windsor and Amherstburg Railway

No additions have been made to trackage during the year, which now stands at 36 miles. During next year it is planned to build a mile and one half, and work is already under way on one and a quarter miles of this extension. Two new cars have recently been ordered for early delivery. A recent order was also placed for an engine and generator of 800 kw. capacity.

Guelph Radial Railway Company

Now operating 8.05 miles of track, 1.1 of which has been added during the year. One double end snow sweeper has been added recently to rolling stock equipment. This was manufactured by the Preston Car & Coach Company and is operated by two motors, Westinghouse 101 B-2 type, with K-10 controllers and with one 101 B-2 motor for broom drive.

The Peterborough Radial Railway Co.

This company operates $6\frac{1}{4}$ miles of single track including 4000 ft. added during the present year. They have recently added to rolling stock, three p.a.y.e. cars and one sweeper, manufactured by the Ottawa Car Co. The power equipment consists of one 200 kw. and one 100 kw. generator, which operate parallel when necessary.

Toronto and York Radial Railway Co.

The total number of miles of single track operated is now 72.43, one mile of switches having been added during the year. Rolling stock has also been supplemented by eight passenger cars of the p.a.y.e. type, two express cars, and eight standard passenger cars.

Sherbrooke Railway and Power Co.

The total number of miles of track now operated is eleven, to which two more miles will be added in the near future. Additions to recent equipment include a snow plough, and two more cars will be added next year.

St. Thomas Street Railway

This system is operated by the city and consists of seven miles of line. A half mile track extension is at present under way and rolling stock is being added to the amount of some \$16,000.

Lake Erie and Northern

Progress is being made on the projected line of the Lake Erie and Northern Railway Co., which will connect Port Dover with Galt. The company will build along its own right of way.

New Faces in Canadian Railway Work

Mr. E. L. Milliken, the recently appointed manager of the Cape Breton Electric Company, was born in Biddeford, Maine, in 1888 and prepared for college at the Technical High School, Springfield, Mass. Graduating from there in 1905 he entered the University of Maine in the Electrical Engineering course and graduated from there in 1908. During his preparatory school and college courses he was employed at different times during vacations, by the Westbrook Electric Light & Power Company, of Westbrook, Maine, now known as the Presumpscot Power Company, as troubleman; by the Coffin Valve Company, of Neponset, Mass., in the brass department; by the Chapman Valve Company, of Indian Orchard, Mass., in the tool making department; by the Bangor & Aroostook R. R., with a survey party relining

track; by the Portland Company, of Portland, Me., in the machine shop, and by the N. E. T. & T. Company, on the inventory in Massachusetts for the Highway Commission. In September, 1908, he entered the Statistics Department of the Stone & Webster Management Association, of Boston.



Mr. E. L. Milliken

Mass., being transferred in October of the same year to the Cape Breton Electric Company, Limited, at Sydney, Nova Scotia. Here he served in the various capacities of light and power solicitor, meter foreman, superintendent of distribution, superintendent of light and power, and on May 1st, 1912, succeeded Mr. H. C. Foss as local manager.

The new superintendent of the Ottawa Electrical Railway Co., Mr. F. D. Burpee, began railroading under Mr. H. B. Spencer, superintendent of the Ottawa division of the



Mr. F. D. Burpee

C. P. R. in 1891. In 1893 he joined the staff of the Ottawa Electric Railway Co. as stenographer to Mr. J. E. Hutchison and has been with the same company ever since as cashier, paymaster, accountant and latterly, assistant to the superintendent.

Track Construction Methods and Costs

Present Construction Methods and System of Supervision and Cost — Keeping on the Montreal Tramways Company's Lines

By Mr. Jos. D. Evans*

The city of Montreal is situated on an Island about thirty-two miles long and ten miles wide surrounded by the St. Lawrence River on the southerly and easterly sides, and the River des Prairies on the northerly and westerly sides, and consists for the most part of a plateau, except for Mount Royal, which rises to a height of 750 feet above the river. The city nearly surrounds the mountain, which, of course, makes some of the streets have steep grades, the maximum being eleven per cent. The average grade for the longest hill, which is 4,100 feet, is 6.2 per cent., and the average grade for the shortest hill is about 10.6 per cent. Our tracks cover the entire island fairly well, but as the streets for the most part are narrow and so laid that none of them can be classified as arterial streets, we have to contend with some difficult problems in construction because the car routes are so laid out that it is impossible to divert traffic on most of them during the reconstruction period, which feature alone increases the costs.

The Montreal Tramways Company controls the following companies: Montreal Street Railway, 148.01 miles; Montreal Park & Island Railway, 53.36 miles; Public Service Corporation, 6.12 miles; Montreal Terminal Railway, 28.42 miles;

The sub-soil in the streets of Montreal is for the most part blue clay, and for this reason we have decided to construct a concrete slab under car tracks with ties spaced two feet centres separated from the slab with one-inch sand cushion. After the rails have been laid and the track brought to proper surface and alignment the ties are entirely concreted in, this concrete serving as a foundation to the pavement. The pavement is either of scoria block, granite block, or granitoid.

Those who have seen the track allowance on the streets on which the cars run may have gone away with the impression that the construction of the tracks is not of the best, but as the city does all the paving construction the company is not responsible for this item, and when the fact is added to this that the foundation under the concrete is in many cases composed of rubbish or a bed of an old creek composed of quicksand or clay, the holding of the track with modern heavy cars passing over it causes the paving to break up rapidly.

Our rail sections are as follows:—80-lb. A.S.C.E. "T," made in Sydney, N.S.; 87/425 Lorain section girder guard, Dick Kerr, 57A; 87/399 Lorain section "T," H. J. Skelton &

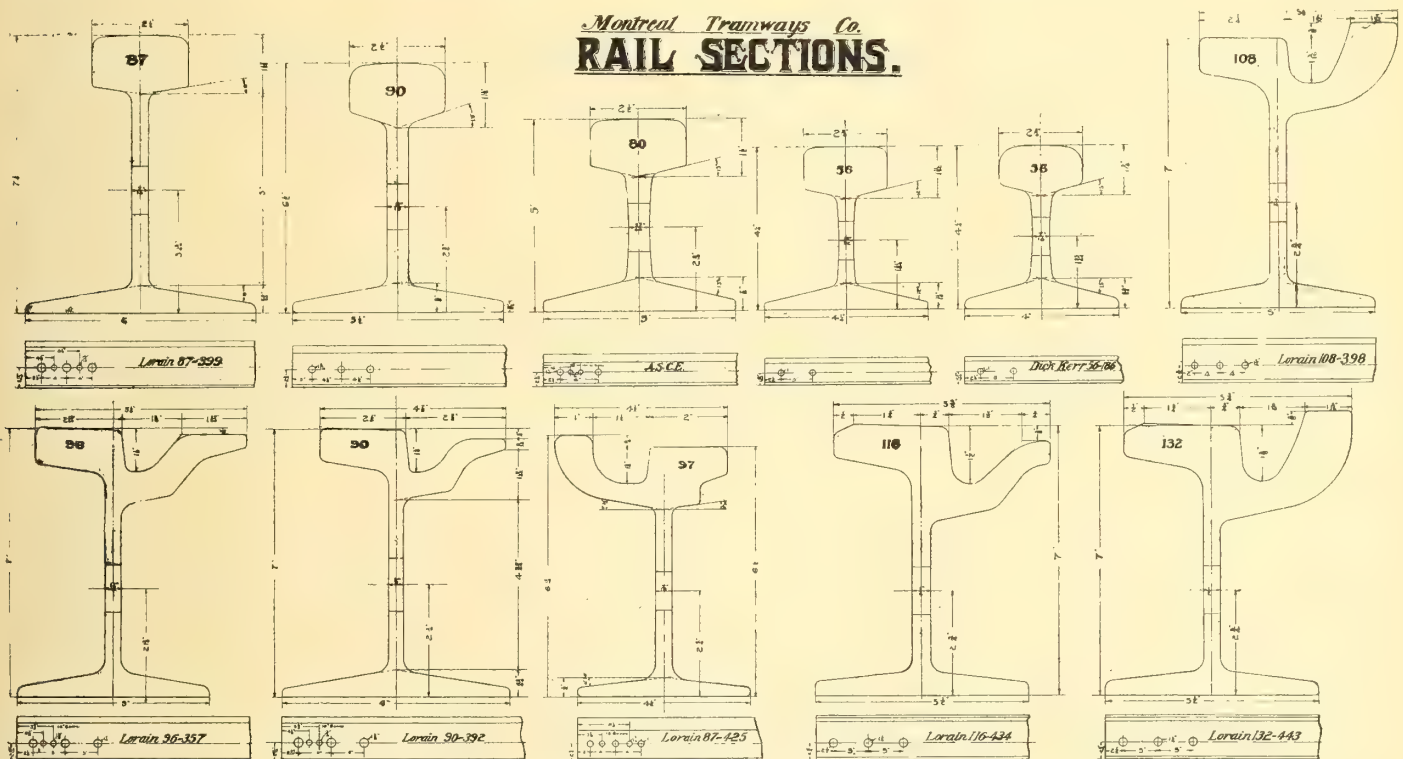


Fig. 1—Rail Sections used by the Montreal Tramways Company

total mileage, 235.91 miles. Of this mileage 172.52 miles is laid on city streets or highways, 39.86 miles on a private right-of-way, 55.14 of single track, and 76.62 miles of double track. The total of siding and car barn tracks amounts to 23.53 miles. Of the track mileage on city streets or highways, namely, 172.52 miles, about four miles of single track and forty miles double track is laid on paved streets; in other words, 84 miles of single track, or 44 miles of city paved streets have tracks on them.

Co.; 87/399 H. J. Skelton & Co.; 96/357 Lorain "Trilby" section; 108/398 Lorain girder guard, Dick Kerr 96C; 116/434 Lorain lip rail, Dick Kerr section 142; 132/443 Lorain guard rail, Dick Kerr section 141.

We have within the last year standardized on three rail sections. For suburban work, 80-lb. A.S.C.E. 5-in. T; 87-lb. T rail 7¼-in. where we are permitted by the city franchises to use same on paved streets; and where we are obliged to use girder rail, we use 116-lb.

Where guard rail is used we install the 108-lb. G.G.,

* Chief Engineer, Montreal Tramways Company

which fishes with the 96-lb. girder rail, and 116-lb. girder rail which fishes with the 132-lb. girder guard. One of the reproductions shown, Fig. 1, illustrates our rail sections used at the present time. The rail plate we have adopted as our standard is the continuous joint 6-hole, shown in Fig. 2. The 116-lb. girder and the 132-lb. girder guard rail sections that we adopted this year we are not perfectly satisfied with because we consider that the back is not bevelled off enough, and we much prefer the 7-in. girder rail sections which were recommended by the Committee of Way Matters at the recent A.S.E.R.A. Convention at Chicago.

As we are great believers in a more flexible foundation for all track construction we have adopted the concrete slab construction which is shown in Fig. 3, and have abandoned the concrete stringer construction and the use of steel ties composed of 4-in. x 6-in. angles and 10-in. channels, for the following reasons:

(1) It affords too rigid a construction and causes the rail to become cupped at the joints, and in case of intersections they pound out much more quickly than on a more flexible foundation.

(2) Where concrete stringer and steel ties were used our experience has shown that the rail could not be renewed and still use the steel tie, because the holes in the tie through which the bolts pass to fasten the rail becomes rusted out, or, if they do not become rusted, any loosening of the tie in the concrete will loosen the grip of the concrete on the

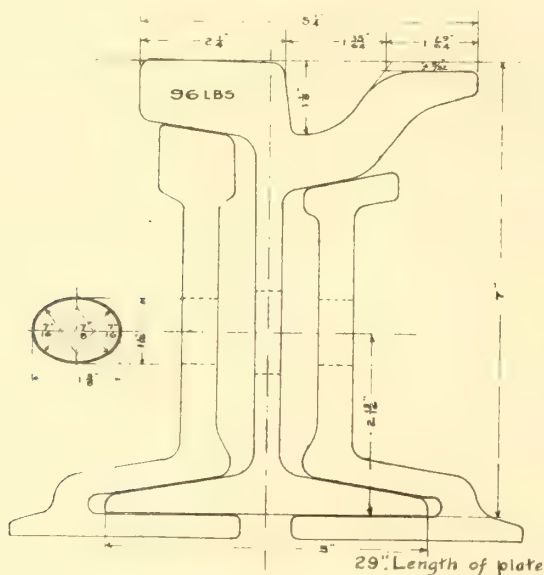


Fig. —Section continuous joint, 6 hole rail plate

head of the bolt, the result being that it is impossible to remove the nut, therefore the bolts have to be cut off and others could not be used without excavating under the tie.

(3) Almost invariably where the rails were placed directly on a concrete stringer with or without steel ties, but with tie rods, this type of construction has proved insufficient to withstand the constant vibration and pounding of cars over it, for in time it causes the cement to disintegrate or crack, thus allowing water to go into these cracks and the action of frost damages the concrete to such an extent that the rails gradually begin to work their way down into same, in many cases as deep as $1\frac{1}{2}$ inches, particularly so at the joints. In some cases where we have used the concrete stringer construction at intersection we embedded inverted scrap rails so that the special work would rest on these without using any ties, and fastened to the inverted rail with special bolts. This type of construction has proven to give too rigid a foundation which lessens the life of the special

work, also the inverted rails cracked the concrete with the same result as above.

Handling Construction Work

We suppose that our procedure in handling construction work is similar to other large electric railway systems with which you are familiar, but nevertheless, we will endeavor to outline the methods used by us.

Our Engineering and Construction Departments are under the direct charge of one head, the chief engineer and superintendent of construction, who reports direct to the general manager. The Engineering Department is under the control of the assistant chief engineer, and the Construction Department under the control of the assistant superintendent of construction, who in turn report to the chief engineer and superintendent of construction. We find that it is better to have these two departments under one head inasmuch as the Engineering Department plan and inspect thoroughly the work carried out by the Construction Department. You will see from this feature that both departments are dependent one upon the other to such a degree that more perfect harmony and better team work results than would be the case if the departments were separated and the head of each department reporting direct to the general manager.

The Engineering Department decides on what work is to be recommended and gets up the detail estimates (except in emergency repairs which are handled by the Construction Department without any estimate as to the work to be done and specifications to be followed) which are approved by the chief engineer. This estimate is then summarized and sent to the comptroller who in turn passes it on to the general manager for authorization. After receiving the general manager's approval the comptroller then sends on work order authorizing the work. This comes to the chief engineer who signs same and sends it to the assistant superintendent of construction with any special instructions he cares to issue which are usually confined to the date when the work is to be started, or any special methods that are to be adopted during construction. As soon as any work has been authorized the engineering department gets out full detail specifications, copies of which are given to the chief engineer, who delegates an inspector to look after the particular job, a copy also being sent to the assistant superintendent of construction, who in turn hands it to the roadmaster for the guidance of himself and foreman in charge of the work.

Instructions to Inspectors

The general instruction that we give to our inspectors we think should be mentioned in this paper, which are as follows:—

1. **Foreword.**—Careful inspection is a vital factor in securing safe and enduring work. No matter how well the engineer may design, his work will come to naught unless his design is accurately carried out by careful and skilled workmanship with good materials, and it is the duty of the inspector to see that this is done. However, the inspector should bear in mind that it must be his object to help and not to hinder the work in progress.

2. **Removing Paving.**—Paving must be removed as specified and care must be taken to see that blocks are piled in such a manner that they will not interfere with any other branch of the work.

3. **Excavating Concrete.**—Concrete is to be excavated under three headings, which are to be specified and classed accordingly:

(a) **Picking.**—As a rule, concrete will be excavated by picking and in the first instance this will be found where, if either of the other classifications are to be followed or not, if the concrete is of medium thickness or is inclined to be soft, picking will be followed.

(b) Hammer Breaking—Hammer breaking should be followed where the picking has loosened up a large block or where the concrete is unsupported by material underneath.

(c) Wedging—Wedging is to be used where the block of concrete is exceptionally thick and starting of the wedge has been made by picking to be used for breaking concrete into large blocks such as can be lifted by the crane or broken by the hammer; also in cold weather wedging will be found the better way to excavate the concrete.

4. **Excavating Macadam.**—Care must be taken to see that the points and elevations as given by the company's engineers are followed exactly and report the foreman in charge of work if he allows his men to cart the earth in shovels to any distance beyond which it may be cast by the shovels, but if the distance is too long to be cast by the shovels wheelbarrows are to be used.

5. **Removing Track.**—Track to be removed is specified and all old rails, plates, switches, ties and other material to be carefully piled and marked (a) "blue," for all material that is considered can be used again with economy and which would be classed as seconds, and (b) "red," material

four spikes, and in the inside of radius of rails of curves to be double spiked. Joints must be well hammered up to place and bolts installed. Care must be taken to see that bolts are not overstrained and lock nuts must be used on all bolts. Tie rods must be installed on all rails above the 5 in. or 80 lb. rail, 4 ft. centres, and nut both inside and outside of web must be well tightened up and the track placed accurately to gauge.

7. **Changing Intersection.**—Inspectors must see that points given by the engineer are followed and special ties laid as shown on plan. No intersection will be laid without special ties except under the order of the engineer. Special heavy National lock nuts will be used on all intersections and care must be taken to see that all bolts are of sufficient length to have at least the full length of the bolt in the nut. At all ends of intersections the high lip on the G. G. rail which stands above the level of the head of the rail must be cut down on an angle to meet the level of the rail. This cut should extend not less than 9 inches on the angle.

8. **Concreting—Storage of Cement.**—The requisites for the proper storage of cement are protection from dampness and from excessive heat. All cement must be piled on raised

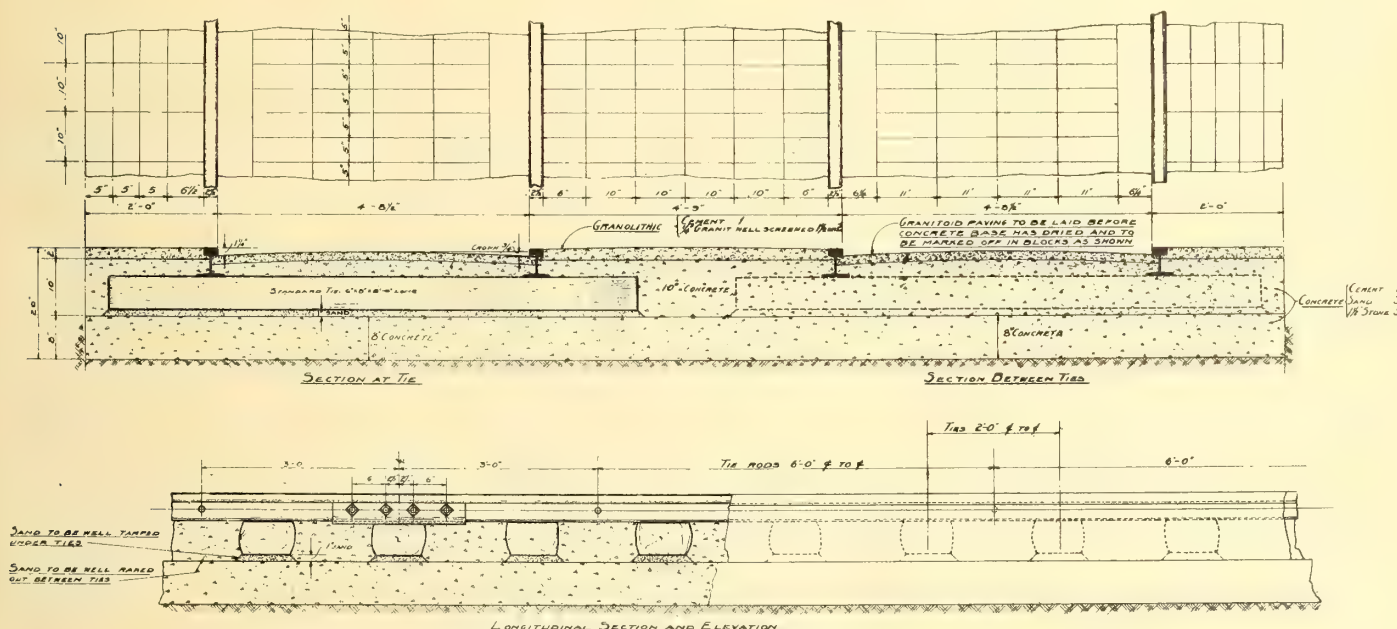


Fig. 3—Concrete Slab Construction provides a more flexible foundation

which cannot be used again and which is to be classed as scrap. In all cases when possible where tie rods and bolts can be saved it will be necessary to see that the foreman does not allow his men in cutting off the nut to injure the bolt or tie rod. This is done so that tie rods and bolts can be used over again by the application of a new nut and having thread cleaned. All material to be taken away to stores yard and report made of same to the office, and receipt to be taken from storekeeper. The different grades of material are to be piled separately in the yard, that is, seconds to be kept separate from scrap, tie rods and bolts to be delivered to the blacksmith's shop to fix up threads and have nuts put on.

6. **Laying Track.**—All track is to be laid on ties two feet centres, standard gauge 4 ft. 8 1/2 ins. and standard devil strip to be 4 ft. 9 ins. unless otherwise specified. Joints must be suspended joints, that is, tie under each end of joint. If a gully or manhole will not permit the proper spacing of ties the stringers must be placed parallel with rail. Specifications as given by the engineering department must be followed absolutely and any deviation from same, at once reported. All ties must be well spiked with

platforms or planks or ties and covered with tarpaulins. Supplies of cement as well as other material must be piled as close to the work as possible, though traffic must not be impeded whatever, in doing so.

Inspection of Sand.—Sand composed of round grains makes quite as strong mortar as does sand composed of angular or sharp grains, but if composed of a mixture of fine and coarse grains would be better, but as between a coarse and a fine sand of one size of grain the coarse sand is better to use. All sand must be clean and sharp as possible.

Inspection of Stone.—Stone should be the size specified and free from dust or loam.

Distribution of Stock Piles.—In slab work stock piles should be so distributed that each pile supplies enough material for a section of slab reaching half way to the next adjacent stock pile and they should not contain more or less material, otherwise a surplus remains to be cleaned up or a deficiency to be supplied by borrowing from another pile. A little care will ensure the proper distribution and more money is saved by not re-handling surplus or borrowed material. The inspector should confer with the fore-

man on the quantity of material thus to be piled and advise him.

Proportioning.—The duty of the inspector is to make certain that the specified proportions are accurately and uniformly adhered to. The inspector should bear in mind that while splitting hairs is not warranted, slipshod and careless methods are not to be tolerated.

Mixing.—See that the mixing operations are conducted according to a regular system, that is, see that the proper mixture of sand, cement and stone is adhered to, and before any work is done, see that regular quantities are understood by the foreman in charge of the work. This permits the inspector to check the work and tends to produce uniformity of product and decreases the necessity of constant inspection for and correction of faults in the mixture. Mixing should be carried out as close to the work as possible.

Preparation of Foundation.—Foundation must be levelled off and compacted and must be thoroughly wetted down before any concrete is placed on it, as a dry foundation draws moisture from the concrete.

Wheeling.—It is important that in wheeling concrete across tracks, boards or runways be laid so that rails are not an obstruction to the passage of the barrows; as the added cost more than counterbalances the time lost in lifting wheelbarrows over obstructions, etc.

Placing.—Wet concrete requires very little tamping or spreading, but care must be taken to see that it is well tamped under rails and ties and that the surface is brought up to the required grade and smoothed and evened, and that expansion joints are left where ordered. Care must be taken not to have longer distance than 60 feet in length of slab. At close of work at night all work must be brought to a finish at the end of a slab.

Wetting down.—In hot weather concrete must be wet down once or twice each day for at least a week after it has been placed in order to allow the inside concrete proper time to set and to stop checking and cracking by uneven setting.

9. **Ballast.**—Unloading ballast.—When ballast is to be spread out over a space of comparatively small area it is preferable to dump the cars using wings to spread ballast, but when material must be spread out to 200 or 300 feet, as in placing final material under ties it is cheaper to drop car doors by pulling out cotter pin at end of levers and unload by hand the quantity required.

Ballasting.—Specifications must be strictly adhered to in regard to depth of fill and size of stone and all ballast must be well tamped and rammed under the ties, especially under the rail and for one foot each side of the rail.

10. **Backfilling.**—Specifications must be followed in this regard where the backfilling consists of material from street or new macadam, it must be well rolled and in the case of new macadam good sand must be used for binding same.

11. **Paving.**—If old blocks are to be re-laid they must be well cleaned and scraped and after rails have been plastered with a mixture of sand and cement they must be laid as specified. Care must be taken that paving is laid as uniformly as possible and that no hollows or irregularities are left in the surface.

12. **Removing Excavated Material.**—Inspectors must see that excavated material is shovelled direct into cars and not carried in shovels. Dump cars should be used wherever obtainable and loads on cars be distributed as evenly as possible.

13. **Bonding.**—All bonds to have brazed terminals and all cable connections down centre of track must be brazed to each rail. 8½ in., 12 in. and brazed cable bonds will

be used as specified and any deviation from this rule must be reported at once.

Checking the Costs

After the specifications as to how the work is to be carried on are issued, the engineering department gets up the details for all the material required for the job, which is sent to the purchasing agent as well as to the assistant superintendent of construction. The purchasing agent sends his copy to the chief storekeeper as his authority for issuing the material shown thereunder, but only upon requisitions from the construction department. It is the duty of the inspectors to see that the material received on the job is properly checked and reported to the assistant superintendent of construction, also to see that old material is returned to the stores department for proper credit. In case the stores department order form does not show the quantity of material required for the job, on account of some unforeseen change, it is immediately reported to the engineering department, which in turn makes out a supplementary statement and sends it to the purchasing agent for him to in-

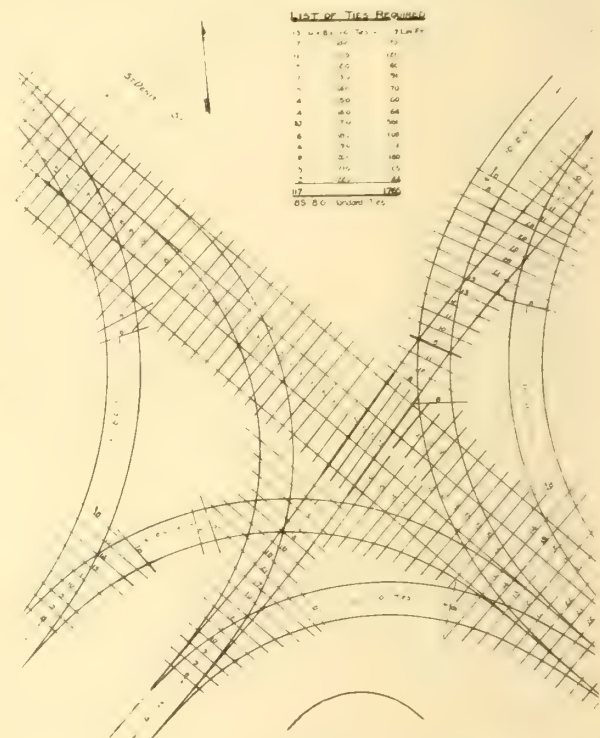


Fig. 4—Typical Plan of intersection

struct the storekeeper. This is done only after the original authorized estimate has been extended by the proper authorization from the comptroller through the general manager.

As soon as the work begins daily reports are sent to the construction department, which are signed by the inspector, checker and foreman. This report must show the quantity of work done under each classification and the unit cost of same. It also shows the material received and sent away.

The daily reports are posted by the cost clerk, whose duty it is to check the daily unit cost for each class of work, and to compute the total unit cost to date as the reports come in, also to enter up the material used.

The chief engineer and superintendent of construction is given a daily statement showing the comparative cost of labor for all construction jobs under way. We consider this report very necessary because the unit costs to date are shown, and if they are running higher than the estimate unit costs an investigation is immediately made and the cause remedied if possible. Besides the unit cost report we are using a report showing the total cost to date. This report

should be used in conjunction with the unit cost report as it is quite often the case that the unit costs are running under the estimated unit costs, but the quantities are over-running the estimated quantities. You can readily see that this will make the actual total cost exceed the estimated total cost.

A very good way to reduce the cost of a given job is, where you have a piece of double track to re-construct, to have one foreman do one side and after this is completed to change the foreman and gangs for constructing the other side. In one case where we did this the foreman who started the work was removed when it was time to do the other side and the foreman who came to do the second track under the same specification reduced the total cost 12 per cent. Of course the second foreman knew that he was being judged by the work of the first foreman, and he naturally tried to win out by beating the other man's labor cost. You can readily see that this brings about a healthy condition of affairs which is to the advantage of the company. We do not feel that this would be good practice for the best results in obtaining first class work unless there is an inspector looking after the quality of the work.

Besides the unit daily reports, we require the inspectors

Cost of Track Renewals

Of seven jobs the unit costs averaged, with traffic running, as follows. These jobs estimated to cost a total of \$88,000:—

Taking up paving, $17\frac{1}{2}$ cents per square yard.

Excavation of concrete, \$2.02 per cubic yard.

Excavation of macadam, 60 cents per cubic yard.

Removing track, 11 cents per lineal foot. This includes entire work of taking up track and transporting material back to store yard.

Tracklaying, 18 cents per lin. ft. This includes taking material from store yards, and laying track completely, spiked and bolted.

Ballasting, 88 cents per cubic yard. This includes the delivering of the ballast and the surfacing, lining and tamping of track.

Concreting, \$1.59 per cubic yard. This includes the labor cost of laying the concrete slab as well as the concrete foundation for pavement.

Paving, scoria blocks, 39 cents per square yard. This includes labor laying and grouting.

Back-filling, 46 cents per cubic yard, including tamping or rolling.

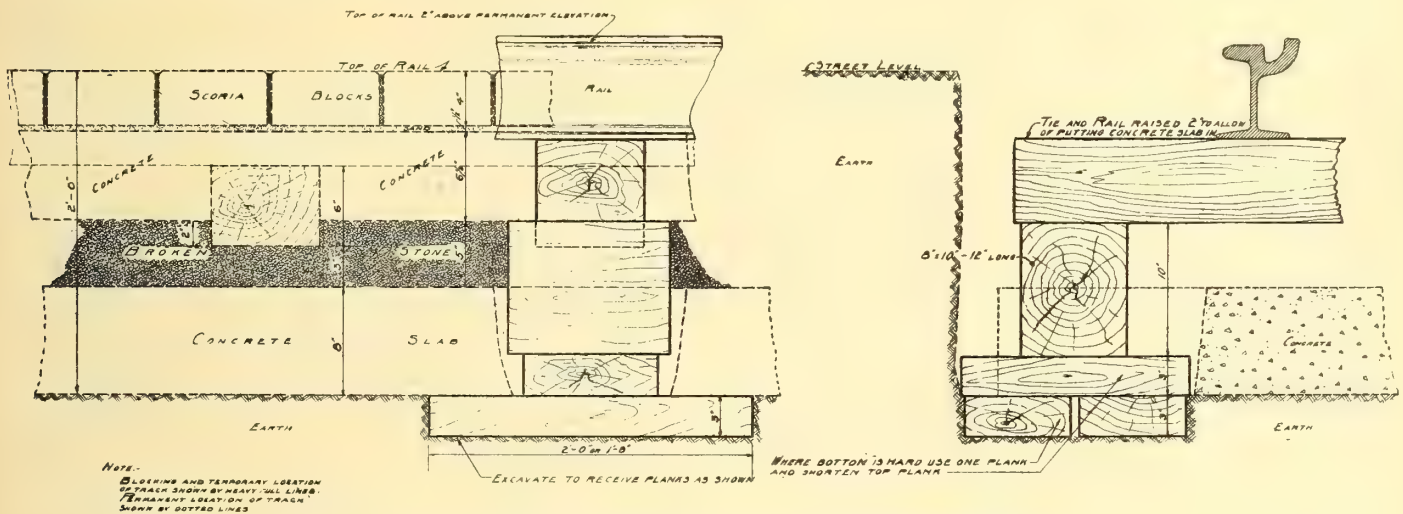


Fig 5—Showing plan of blocking up rails so concrete slab can be laid

reporting to the engineering department to make out a daily diary of all work done, forces employed, etc., as well as to describe any accidents or anything unusual which might happen. These reports make interesting reading and help to keep the chief engineer and the entire office staff up to date as regards the details of construction which is very important if one is to superintend by being entirely conversant with all the facts, and not to superintend in name only.

We are of the opinion that we are getting the right kind of data as to cost keeping by the shortest methods, and one thing we are sure of, and that is, that we know what is going on at all times, which we feel would be impossible if we did not have the present system in force. We make it our aim to have a logical reason for doing everything and we are not afraid to say that we make mistakes, but we try not to make the same mistake in the same way the second time. We consider that by having the general instructions to inspectors carried out that it will continually aid in the reduction of the unit costs.

The unit costs of our work are affected by traffic conditions: (1) keeping cars running, (2) keeping streets open for vehicular traffic. It is very seldom that we can have the full use of any street and the tracks for re-construction purposes. We cite below some of our unit costs.

Removing excavated material, 61 cents per cubic yard. This includes labor and transporting material to dump.

Bonding Costs

The bonding unit costs on the above jobs are as follows:—

Stringing cable, 2 cents per cubic foot. Includes transportation of material from the stores department.

Drilling holes for cross bonding, $8\frac{1}{2}$ cents per hole.

Installing cable bonds (plug terminals), 16 cents per bond.

Installing brazed bonds, $14\frac{1}{2}$ cents per bond.

Grinding for bonds, $8\frac{1}{2}$ cents per joint.

Cost of Intersection Renewals

On six jobs the unit costs ran as follows:—

Taking up paving, 13 cents per square yard.

Concrete excavation, \$2.55 per cubic yard.

Macadam excavation, \$1.13 per cubic yard.

Removing track, $15\frac{1}{2}$ cents per foot. Laying track, $43\frac{1}{2}$ cents per foot. These prices for removing and laying are high because the track laid was only 15 feet on each end of the intersection, the quantity being small.

Ballasting, \$2.09 per cubic yard. This item is high, because ballast is only one inch thick under the tie, quantity small as compared to the labor.

Laying concrete slab and concrete for paving base, \$1.75 per cubic yard.

Paving, scoria block, 37½ cents per square yard.

Removing excavated material, including transportation to dump, 57 cents per cubic yard. Unit cost dependent upon haul to dump.

Labor, changing intersection, averaged \$405.00 per intersection. This item includes taking new and old material to and from store yard.

Cost of Bonding Intersection

Stringing cable, 3/5 cents per lineal foot.

Drilling holes, 8 cents per hole.

Installing cable bonds, 11 3/5 cents per bond.

Installing brazed bonds, 23 cents per bond.

Grinding for bonds, 17 cents per joint.

The costs in the two latter cases change depending upon traffic conditions.

Intersection Work

Our intersections are mostly constructed of solid manganese steel to the rail sections specified for all switches, mates, frogs, crosses, etc., and for city work we adopted as our standard this year, Lorain Steel Company's section 116-434 girder rail and 132-443 G. G. rail which fishes together, thus doing away with compromise joints. We have given up the idea of having the outer rails of curves guarded and all curves are made transition to gauge, namely 4 ft. 8½ in. We require the manufacturer when accepting an order to agree to the following guarantee:—

"The manufacturer agrees to replace:—

- (1) Material in which defects develop within one year, at his sole expense.
- (2) To replace any part of a given intersection that fails within the second year at fifty per cent. of its value.
- (3) To replace any part of a given intersection that fails within the third year at 66 2/3 per cent. of its value.

The most difficult part of our track work to construct and maintain is the intersection work, because we always have to carry on the work by keeping the traffic running, and the headway of the cars is often very close and when the vehicular traffic is added to this, the wear and tear in the roadbed is found to be enormous. The most essential thing requisite in an intersection is a good foundation, not that the most rigid foundation is the best, as we have explained elsewhere, but it should be placed on a well drained sub-base with good stiff construction (concrete slab) over it to support the ties, rails and pavement. Various methods of designing the foundations for intersection work have been tried and our experience teaches us that with a more flexible foundation the life of the special work exceeds the life when placed on a rigid foundation, and with this in mind we have adopted the concrete slab 8 in. thick on a well compacted sub-base with 1 inch sand cushion between it and the ties, the same general type of construction as is used in our straight track work referred to in the beginning of this paper. As cited above we are constructing all intersections with traffic running, the only time cars are stopped is during the actual removal of a given intersection, and the placing of the new intersection which is usually between the hours of 8 p.m. and 5 a.m. Some of the smaller intersections are changed in five hours. We bring into use to a great advantage in changing the steel work of the intersections a five-ton electric traction crane. When we have an intersection to renew we confer with the superintendent of transportation as to the most convenient time for him to give us full use of the particular location in order to divert the traffic by other routes. As soon as the date is arranged when the cars can be diverted we start removing the paving blocks, and after this work is completed we arrive on the job on the appointed day at 8 p.m. with the electric

traction crane and all material loaded on flat cars. As soon as the joints have been disconnected the crane car begins to remove the intersection and place the pieces on the side of the street. After they have all been removed the crane hoist begins to unload the new material and set it as close to final position as is practicable. The new work is painted in colors to correspond to the corners at which it is to be finally placed, as shown by erection plan. After the new material has been all unloaded and placed, the crane car is then put to work loading the cars with the old intersection and returns to the store yard. The crane car has reduced the cost of our work and is absolutely necessary on account of the increased weight of the intersection parts; also we do not require as many laborers and the street is not blocked with any of the intersection material. As soon as the new intersection is placed traffic is resumed and we then start the excavation, the sub-grade being 24 inches below the top of rail. This work is carried on hand in hand with the placing of the ties. We have adopted long ties, that is, ties varying in length from 8 ft. to 20 ft., the longest ties taking in the four rails. The attached plan shows the spacing of the special ties with the list as to sizes that are in addition to the regular standard 8 ft. ties. See Fig. 4.

We use all ties sawn at least on two sides, the extra long ties being sawn on four sides, no hewn ties being allowed, where concrete slab construction is adopted on account of their varying thickness and unevenness. As fast as the excavation is completed and the ties placed in final position we block up the intersection per plan shown in Fig. 5, so that the concrete slab can be laid and allowed to thoroughly set without carrying any load from the cars while running over the intersection. After the concrete has set for ten days the intersection is tamped up with one inch of sand under the ties and brought to final surface. After this has been completed the concrete is placed for the pavement. As soon as this concrete has set from four to seven days we start laying the pavement which completes the job.

We feel that the Montreal Tramways Company's work ranks with the best of railroads in America and we believe one reason for this is on account of the efficiency and loyalty of the employees working together systematically.

Diesel Oil Engine Auxiliary Station at Oshawa, Ont.

The Electric Power Company have under construction at Oshawa an oil engine plant, as an auxiliary and standby for their high tension transmission system. The first installation will consist of one 650 h.p. Diesel oil engine direct connected to a 500 kv.a., 3 phase, 60 cycle, 180 r.p.m., 4160 volt generator. The engine and generator are being furnished and will be installed respectively by Messrs. Willans & Robinson, of Rugby, England, and Messrs. Kilmer, Pullen & Burnham, of Toronto.

The building now being erected is designed for two units, but is so arranged that it may be easily extended to house four additional units similar to the above. This plant is arranged for standby service for the Oshawa Electric Light Company, and also to feed into the Seymour Power & Electric Company's 44000 volt transmission system through the step-down sub-station at Oshawa.

This plant is being built under the supervision of Messrs. Smith, Kerry & Chace, of Toronto.

Boehner Bros. of West LaHave, N.S., whose wood-working factory was completely destroyed by fire, are rebuilding a modern plant at that point and have placed orders with the Canadian General Electric Co. for a complete electrical equipment including generating equipment, motors and wiring material. When completed this factory will be one of the most modern in Canada. The power house, and also the dry kiln will be located some distance from the wood-working factory.

The Advent of the Gas-Electric Car

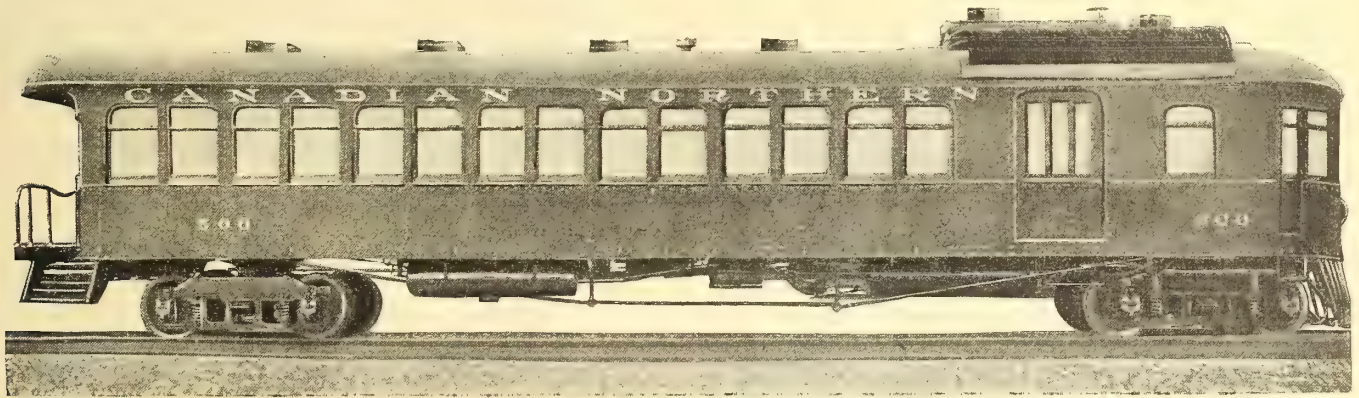
In early May of the present year, one of the most modern developments of railroading, a car of the gas-electric type, purchased by the Canadian Northern Railway Company from the Canadian General Electric Company, was placed in service between Quebec and Lake St. Joseph, on the Quebec and Lake St. John Railway. From the first day of its introduction, the car has enjoyed most enthusiastic public approval and patronage, and has attracted widespread attention.

Gas-electric motor cars are now operating in an eminently successful manner on a number of important railways in the United States as well as Canada. In performing service on connecting lines, or as adjuncts to the main line equipment, wherever self-propelled cars of this type have been adopted, they have merited the favor of railway officials and gained lasting popularity with the travelling public. Operation under nearly every traffic condition has demonstrated that they afford a safe, reliable, pleasant, convenient and economical means of travel and fulfil the requirements of steam roads for supplementary service in every respect.

rolling stock, a general description of its construction and mechanical and electrical features will prove instructive.

The gas-electric motor car is essentially a locomotive and car combined in one unit. It has been developed and perfected by the General Electric Company, and in its design are embodied the essentials of simplicity, ease of control and resultant safety in operation. The motive power centers in an internal combustion engine, generator and the motors. In view of the high character of the power equipment the aim has been to produce a car with commensurate solidity and durability, and with both beauty of design and furnishings. Several standard styles of car bodies have been established to meet practically all requirements, but a wide range of types can be furnished in response to demands for special arrangements of seating, smoking, mail and baggage compartments. But one motorman and one conductor are required to operate the car.

All-steel construction, except the interior finish, prevails throughout. The frame consists of steel I-beams and channels, strongly cross-braced, and steel plates from the



Gas-Electric Car in service on a branch line of the C.N.R. between Quebec and Lake St. Joseph

Branch lines are sometimes operated at a loss by steam, due to the small amount of travel; and in this province the gas-electric car is solving an annoying problem of railroading and is proving its ability to reduce operating expenses. Not only are transportation costs per passenger lowered by the introduction of these cars on local divisions, but traffic is greatly stimulated through the readiness of the public to take advantage of the increased pleasure of traveling in cars with the comforts of Pullman service and with an absence of smoke and cinders.

In making the trip between Quebec and Lake St. Joseph, the Canadian Northern gas-electric car covers a distance of 22 miles. Eight daily single trips constitute the schedule, which totals average runs of 175 miles per day, exclusive of Sundays. Eight miles of this run out from Quebec are over 1½ per cent. grade, and a trailer weighing 35 tons is hauled one trip per day from Quebec over this grade. At the present writing repairs on both the car and engine have been practically nil. The consumption of gasoline has averaged one-half gallon per mile.

The car measures 58 feet 6 inches long, 10 feet 5 inches wide and is partitioned into four compartments; one 25 feet 6 inches long for passengers; a smoking compartment, 10 feet long; baggage section 6 feet long; and the engine cab, 12 feet long, containing the power plant apparatus. The net weight of the car is approximately 39½ tons and it has a seating capacity for seventy-six passengers. In view of the unusual popular interest manifested in this modern type of

outside sheathing. The under-floor of the car is of wood, sheathed with sheet iron on the lower side; while between this and the floor proper a heavy felt lining is inserted, and the car sides are also interlined with felt. Cars having centre entrances are built with the "turtle back" design of steel roof and rear, and may be provided with an observation platform and rear entrance, or both rear and centre entrances are furnished.

In general, the interior trim is of mahogany highly finished, and the ceiling is sheathed with composite board. The windows are fitted with plate glass; the seats are made long enough to accommodate three persons, are covered with friezette plush in the passenger compartment and with genuine Spanish leather in the smoking room, and the entire car is lighted with attractive electric incandescent fixtures.

The generating unit is located above the floor line of the cab, free from dust and dirt and under immediate observation of the engineer. It consists of an 8-cylinder, 4-cycle, gas engine of the "V" type, direct connected to a 600 volt, commutating pole electric generator, designed to meet the special conditions the service demands. Flexibility of control and economy of operation are assured through electrical transmission of the power. The starting of the engine is effected by compressed air taken from the main reservoirs of the air brake system, which are built with surplus capacity for this purpose. The main air compressor is driven from the crank shaft of the main engine, and is fitted with an automatic governor which maintains a constant pressure.

The engine can rotate at normal speed, irrespective of the speed of the car, and deliver its maximum power, a feature of great advantage on grades, in the case of snow storms, or other emergency conditions.

An auxiliary equipment is also provided, consisting of a 2-cylinder, 4-cycle gas engine direct connected to a single cylinder air compressor and lighting generator. The function of this set is to supply an initial charge of air for starting the main engine and to deliver power for lighting the car. This set is started by hand.

The control is simple, substantial and similar to that of any standard electric trolley car. Mounted on the axles of the forward truck are two GE-205, 600 volt, box frame, oil-lubricated commutating pole railway motors of 100 h.p. each. Years of experience have demonstrated that there is no piece of apparatus less liable to derangement than the railway motor built for heavy, high speed traction work. By means of a special controller they are placed progressively in series and parallel connection. Energy is transmitted directly without the intervention of mechanical change speed gearing. The voltage is governed by varying the strength of the generator field, which is accomplished by the movement of a single handle on the controller, and the resultant speed changes of the motors produce a smooth and rapid acceleration without rheostatic power losses or gear changes. Separate handles are provided for throttling the engine and for reversing the car. The latter is accomplished instantly by changing the motor connections in the usual manner, without stopping the engine, which always rotates in the same direction. This allows the cars to be stopped quickly independent of the brakes in an emergency. All the levers are located within convenient reach of the operator. The radiators are placed on the roof and circulation for cooling the engine is maintained by the thermo-siphon system.

The trucks are of the swing bolster type with elliptic bolster springs and coil equalizer springs. The bearings, treads and flanges of the wheels and axles conform to the standards of the M.C.B. The brake equipment includes hand brakes in addition to the combined straight and automatic air brakes. A high power Mazda incandescent headlight and reflector, an air whistle and a pneumatic gong are provided. A hot water heater, coal fired, is installed for heating the car. To prevent freezing in cold weather when the car is lying idle, the heater circulation may be connected to the engine cooling system. A 150 gallon gasoline tank for the power supply is suspended under the car. While the car is running the gasoline is pumped automatically by the engine, and by a hand pump when idle.

A Centre Entrance Gas-Electric

Another and later type of gasoline-electric car is also being tried out at the present time by the Canadian Northern Railway Company. This is what is known as a Merkle system of self-propelled cars. The general dimensions of the car are 35 ft. in length over all, 7 ft. 9 ins. inside width, with a combined height from rail 11 ft. 8 ins. The weight of the equipment is approximately 25,000 lbs. Seating capacity of the car is thirty-eight passengers, but on occasion one hundred and twenty-five people have been carried.

The entrance and exit of this car are of the side, centre-entrance type. The car is double ended and operated from a cab located in the corner of each end, occupying a very small space.

The truck used is the Barber truck and the car was manufactured originally by the Barber Car Company, of York, Pa. Canadian rights are now held by the Preston Car & Coach Company, who will manufacture in Preston for Canadian trade. The truck is solid and substantial of a type ordinarily known as "bridge construction." The wheel base

is ten feet and is equipped with four sets of springs, one upon each end and two on the sides. The end springs are of the rocking type and are fastened to the under frame of the bottom of the car. The body rests entirely upon a steel sub-frame attached to these springs. The car is said to ride very easy, without a teetering or rocking effect or rolling motion.

The propulsion of the car is by a four-cylinder, four-cycle gas engine rated at 36 horse power, 600 r.p.m., direct-connected to a 20 kw. compound wound differential pole gen-



Gas-electric single-truck car—Centre entrance type

erator. The engine is manufactured by Blount & Lovell, Boston, Mass., and the generator by the Deihl Manufacturing Company, Elizabethport, New Jersey. This combined unit is mounted on a rigid framework of rectangular form which is brought up from underneath the truck and mounted on a saddle or spring suspension in such a manner that the movement of the truck imparts but little strain to the power equipment.

The motors of the car are of the compound wound type having a heavy series winding and are of approximately 25 h.p. each, geared to the axle in the usual way. These motors are so connected to the generator that it makes a very flexible unit and entirely eliminates the resistance, controller and cable methods.



Plan of above—Seating Capacity 38

The artificial lighting is accomplished by a small storage battery, which battery is also utilized for the starting of the engine.

The car appears to be specially fitted for light suburban or tail-end service. Records of actual operations show an average consumption of one gallon of gasoline for every six miles of operation. The cost of the car is approximately \$10,000. The speed attained on the level is up to thirty miles per hour. It is understood that a somewhat larger type of car is now being constructed with an 18-in. wheel base and equipped with a six-cylinder, 54 h.p. engine.

At Danville, Que., the death occurred early in October of Mr. George F. Cleveland, of the firm of J. L. Goodhue & Co., manufacturers of leather belting.

The Storage-Battery Railway Car

By Mr. A. E. Wilkes

The growth in railway facilities during the last few years has been rapid and enormous, yet it can safely be said that it has not kept pace with the ever-increasing demand for quick, safe, comfortable and cheap transportation. Naturally enough, with the constant developments, fresh and new efforts to perfect and extend railway systems are always in the eyes of engineers to embrace every requirement, from the transcontinental "Flyer," operating at high speeds, to the small suburban track operating in a rural district with small habitation.

Methods adopted and developed to meet various forms of car propulsion number some hundreds, each possessing features well adapted to its particular sphere of activity. Thus, car propulsion may be safely divided into two classes, those whose units are supplied from a central generating station with which they must always be in contact, and those employing self-contained units. The first class includes the third rail, conduit, and trolley systems, which have been developed in great variety and to meet speed and load conditions ranging from the hauling of heavy train units by electric locomotives to small single track overhead trolley street car operation.

Such systems, however, are only applicable to conditions wherein the amount of traffic is of sufficient volume to call for train operation at intervals fairly frequent, resulting in a number of car miles per mile of track per annum.

The investment necessary for third rail, trolley or underground construction and the maintenance charges incident to their use create an expense that is more or less high, which must be borne by the car miles actually operated, whether great or small.

For traffic below a certain density, the operating and maintenance expenses are prohibitive when the number of car miles per mile per annum are calculated. Yet the expense which actually results from the running of the equipment and which is approximately proportioned to the amount of operation (and, therefore, constant per car mile) is relatively low with such systems.

Methods of car propulsion where self-contained units are employed, involve, in general, a lower ready-to-run and a higher true-running expense than systems distributing power from a central generating station to connected units, and such self-contained units are able to show a lower gross operating expense where the traffic density is low than can units taking power from a third rail or trolley.

During the past few months it will have been apparent to all those interested in car propulsion that the storage battery propelled railway car has commanded an amount of interest and attention on account of its ability to occupy a broad transportation field which has hitherto been practically undeveloped because of the lack of suitable self-contained units.

There are a number of applications to which the storage battery railway car may be successfully adapted, and the following may present favorable suggestions:

1. Short suburban lines, meeting a distinct transportation need, the rural lines not being connected with any other system.
2. For the operation on single track roads where not more than one car per forty-five or sixty minutes will be run each direction.
3. Extensions to existing electric systems serving districts which it is desirable to develop, but where the

immediate traffic will not warrant overhead construction equipment.

4. As an adjunct to steam lines to supplement regular steam service, furnishing local service at short intervals and to branch lines, particularly on roads devoted to freight service and without passenger service, but insufficient traffic to justify regular steam train operation.
5. Small lines to meet some form of local condition other than general public service, viz.: between mills or factories and a main railroad depot or residential centre, belt line service in large manufacturing plants, etc.
6. For where local ordinances do not permit the use of overhead equipment.
7. For providing an infrequent "night owl" service.

Initial Cost

Coming along to the other question of initial cost of the lead storage battery car, it is quite apparent that there is an absence of cost of overhead construction, of feeders, track bending, in addition to a large part of the power house investment required for overhead operation.

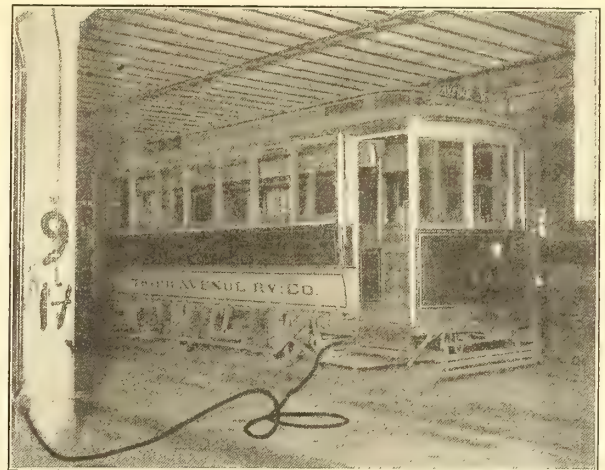


Fig. 1.—Storage battery car being charged

If the cars are operated in connection with an existing electric line, the batteries may be charged from the generating station during hours of low load, and therefore calling for no increase in station capacity.

If used to operate an independent line, charging current may frequently be taken from a local central lighting plant thus removing any investment for power house equipment.

If current cannot conveniently be obtained and it is found necessary to provide charging plant, only one-third to one-half the capacity in boilers, engines, and generators will be needed as for the same number of trolley cars on account of uniformity of the load.

Since the first cost of storage battery cars, complete, ready for operation, is about one-third more than that of standard trolley cars of the same seating capacity, the total possible saving in initial investment as outlined above may be very considerable, with a resulting decrease in interest and depreciation charges.

The cost of power per car mile for lead storage battery car is less than the trolley, and considerable economy in this

department reflected. Lead storage battery cars are now fitted with roller bearings and together with other refinements throughout the construction of these cars, result in a very low power consumption per car mile.

Two styles of cars are now being marketed, one a single truck, the other a double truck. The former will accommodate twenty-eight or thirty passengers, the latter thirty-six to forty, according to body design. In both the single and double truck cars, a compartment is set apart for smoking,

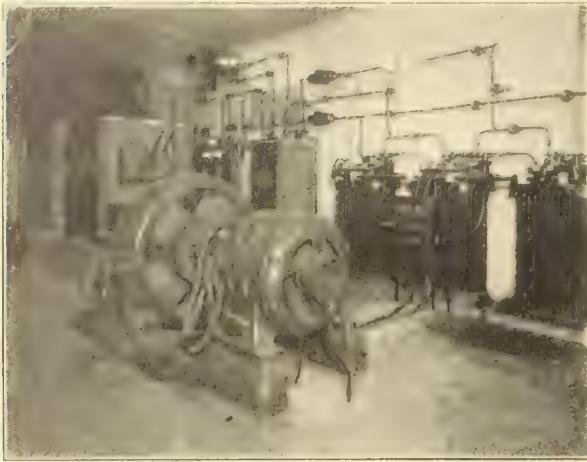


Fig. 2.—Generator equipment for charging battery

and in addition to this, the double truck car can also be fitted and partitioned off to make a baggage compartment. Both types of cars can be fitted with hot water or hot air heating when desired.

In the case of the single truck car, standard, the battery equipment consists of fifty-eight cells of type MV-29 "Hycap-Exide" and the double truck eighty-eight cells of the same type.

The motor equipments are furnished by the General Electric Company and the car bodies by the Brill Company.

These three companies are co-operating in the design and production of these cars, and it is hardly necessary to mention that each, a specialist in its particular field of activity, makes the lead storage battery railway car an equipment which should inspire the confidence of all those interested in equipments of this character.

In conclusion, a word as to the performance of these cars will be of interest. They will make fifteen miles per hour on a level track, and will readily negotiate a seven per cent. grade with full passenger load. The power consumption per car mile will vary according to the track conditions, grades, and number of stops.

The input to car motors will average 450 watt hours per car mile. With a power consumption of 450 watt hours per

car mile, the car will make 80 to 100 miles on a single battery charge, on the basis of six-hour battery capacity above certified, while over one hundred and twenty miles have been recorded on a single charge in actual service.

The above is a reasonably conservative estimate of what can be done under conditions which may ordinarily be expected. That is to say, moderate conditions as to number of stops, grades, curves, etc. As in the case of electric automobiles, it is unwise to attempt regular schedules requiring the full mileage capacity, but some margin of safety should be allowed. Thus, a single truck car should not be asked to cover a schedule calling for more than about eighty-five miles without recharging, and the double truck approximately sixty-five miles.

If the desired mileage is within these figures then only one complete or gassing charge per day need be given to the battery, and this will preferably be done at night and at a moderate rate in order to secure maximum efficiency, minimum wear and tear on the plates and the favorable rates for charging current which are usually made for such night or off-peak loads.

When, as may be required, cars are required to run each day a total distance in excess of the capacity on a single battery charge, boosting or partial charges during lay-overs between trips may be given.

The foregoing is a general statement but each situation requires individual and careful study before manufacturers can make definite recommendations.

From the foregoing outline given in this article it will be seen that the lead storage battery car of to-day presents an attractive method of handling traffic of low density per mile of track.

The Corporation of Pictou have recently closed a contract with the Robb Engineering Co. and the Canadian General Electric Co. for a duplicate of their present power house equipment. When this is installed it is their intention to operate a day service supplying power to the different industries and also pumping the town water.

Canadian Street Railway Association

The Canadian Street Railway Association held its annual convention in London, October 4 and 5. A number of interesting papers were read by members of the association, and officers were elected for the year as follows: President, Mr. Patrick Dubee, Montreal; vice-president, Mr. C. B. King, manager of the London street railway; secretary-treasurer, Mr. Acton Burrows, Toronto; executive committee, the officers and Messrs. H. M. Hopper, St. John, N.B.; J. E. Hutcheson, Montreal; Jas. D. Fraser, Ottawa; Wilson Phillips, Winnipeg, and E. P. Coleman, Hamilton. The accompanying photograph shows a group of delegates containing a number of well-known electric railway men.



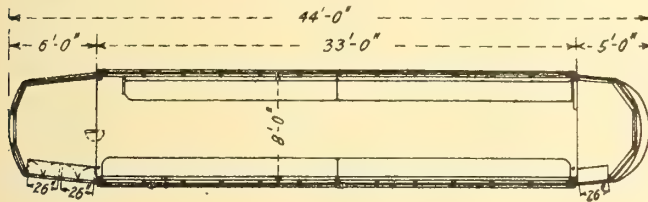
Group of delegates attending the recent Canadian Electric Railway Association Convention at London, Ont.

Prepayment Cars in the United States

An intimate study of the latest types of pre-payment cars used in various cities of the United States was recently completed by the Mechanical Department of the Brooklyn Rapid Transit Company. This information has been compiled in book form and bound, thus constituting a volume which contains practically all the available information on prepayment cars as operated in the United States. A brief resume of the report with reproductions of the plans of the different designs is given herewith.

Cincinnati Traction Company

The latest type used by this company, of which fifty are in operation and fifty under construction, are of the pay-within type with longitudinal seats. These cars are arranged for single end operation with folding doors at one side of car only. A feature of the door arrangement is the use of glass in lower panels so that the conductor can obtain a better view of the street and the step. Steps are stationary, doors being located flush with the outside edge of same and swinging inwards. This provides for very easy operation



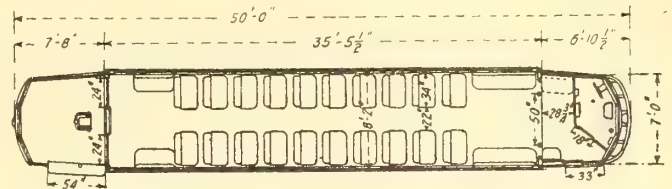
of doors and considerably simplifies the mechanism. The exit and entrance doors on the rear platform are operated independently. A clear space of 26 inches is provided on both the exit and entrance side when doors are open. The car has a double seating capacity of forty-three passengers allowing approximately 18 inches per passenger. The officials of this company believe that the pay-within type of car is the most desirable on account of the decrease in accidents due to boarding and alighting, and to the better protection afforded the conductor. The step height is 17½ inches from rail to top of step and 13½ inches from step to platform.

Cleveland Railways Company

This company operates 852 cars, of which 230 are of the p.a.y.e and 622 of the pay-within type. The latter type of construction was used for rebuilding old equipment on account of this arrangement lending itself better to the remodeling of the old standard cars. Even the standard type of open cars were rebuilt to this plan by cutting off the old platforms and adding new platforms containing necessary features for prepayment plan and by installing removable sides. All new equipment purchased since the prepayment form of construction was adopted has been of the p.a.y.e. type with one side of rear platform open and divided by a stanchion which serves as a grab handle as well as a division between the entrance and exit. The cars are all arranged for single end operation and no railings are used on platform except as a protection around the fare box. A most striking feature is the large spacious platform. While this may be considered as waste space during light and ordinary traffic, the report states that from observations made, it is evident that, during rush hours, boarding delays are reduced to a minimum.

The car is unusually large for city service, measuring 35 ft. 5½ ins. over body corner posts and 50 ft. over bumpers. There are twenty transverse seats, each 34 inches wide, spaced

29 inch centres, with a 22 inch aisle. Longitudinal seats for four passengers are arranged at each side on forward ends and for two passengers on each side at the rear end. A permanent cabin with sliding door is provided for the motorman on the front platform so that he is entirely enclosed. This is considered an advantage as it is sometimes necessary in stormy weather that the motorman operate with the vestibule sash partly open, to enable him to see

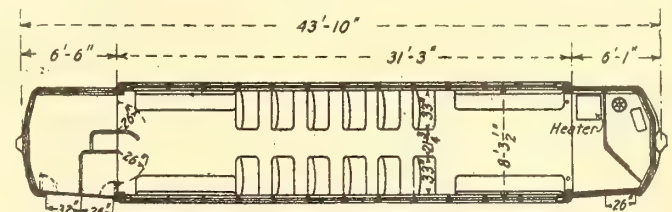


better. Also it prevents any possibility of passengers conversing, or interfering in any way, with the motorman.

Accounts taken of the length of time required by passengers to board the cars during rush hours show that the p.a.y.e cars average 1.47 seconds per passenger and the pay-within cars, 1.51 seconds per passenger. The report adds that though the result seems slightly in favor of the p.a.y.e. type, this is more than off-set by the greater chance of boarding and alighting accidents which are practically eliminated where doors are placed at the sides of the platform.

Detroit United Railway Co.

The latest standard cars of the D. U. R. Co. for their city service are of the single end pay-within closed type with combined transverse and longitudinal seating. The car has a seating capacity of 48 passengers, of which 24 are on transverse and 24 on longitudinal seats. The cars being single ended, the transverse seats have stationary backs which permits the use of a longer seat cushion than on reversible seats of the same overall length. The rear platform is 6 ft. long from end of body to the inside of vestibule finish and is provided with two sets of two leaf swing-

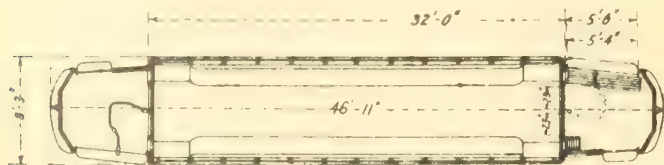


ing doors, one for the entrance and one for the exit side, each operated independently of the other. A railing divides the entrance and exit and extends to the inside of the body and partially around the conductor's position. The doors are manually operated by the conductor. The bulkheads on both ends of the car are open almost the full width of the car and a pipe stanchion is provided on each side of the bulkheads, forming hand-holds for the passengers as they are entering or leaving the car. The forward platform has a partition built at the back of the motorman which partially encloses him; a railing and chain complete the enclosure.

New York Railways Co.

This company has finally adopted a two motor double end p.a.y.e. car. The platforms are of a standard p.a.y.e. type, operated with one side open and stationary steps. A

stanchion is provided to divide the entrance and exit, a clear opening of 38 in. being provided on the entrance side and 24½ in. on the exit side. On the front end of car this opening is closed with a two-leaf hinged door. At the exit side on the forward end, a sliding door is used, manually operated by the motorman. Instead of doors being placed at each side of car with a partition in the centre portion of bulkhead for sliding door, both the entrance and exit doors are located in the centre of bulkhead with a dividing post in the centre of opening for doors to strike against and to serve as a division between in-coming and out-going passengers. Two folding seats are provided

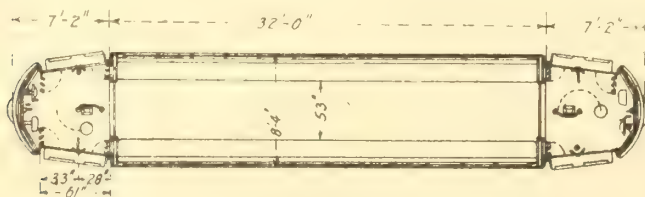


on each platform, one on the controller side, accommodating four passengers and a single seat on the brake side adjacent to bulkhead of car. These folding seats are used only on the forward platform. Longitudinal seats are provided extending the full length of the car body. 42 passengers can be accommodated inside the car, allowing about 18 in. each, which, along with the five seats provided on front platform, gives the car a total seating capacity of 47.

The New York Railways Co. are now experimenting with centre entrance cars with drooping body so that the floor will be only 10 in. above the running rail. (See May 1912 issue Electrical News).

New Jersey Public Service Railway

All new cars purchased or built by the company since 1907 have been of some form of prepayment type and a large portion of the older equipment has been rebuilt for prepayment service. The company have three distinct types of prepayment cars in service, (a) p.a.y.e. (b) pay-within, (c) pay-on-platform. The p.a.y.e. type has separate entrance and exit in bulkhead but differs from the usual p.a.y.e. arrangement, in that gates are provided at side of rear platform. The pay-within type has bulkhead entirely removed and the conductor stands in the bulkhead opening. Doors are used at the side of platform on these cars. The pay-on-platform type, has double sliding doors in bulkheads and 2 two-leafed hinged doors at side of platform, each door operated independently of the other in the rear, but arranged to operate together on the front platform. The pay-



on-platform arrangement has been adopted for new equipment. The latest standard car may be described as a double entrance pay-on-platform car. Longitudinal seats are provided, this type being favored by the management on account of its better adaptability to heavy traffic conditions and seat service in general. The standard seat car has a 32 ft. body and measures 46 ft. 4 in. over bumpers. The width over side plates is 8 ft. 2½ in. giving a clear space between longitudinal seats of 53 in. The seating capacity is for 42 passengers.

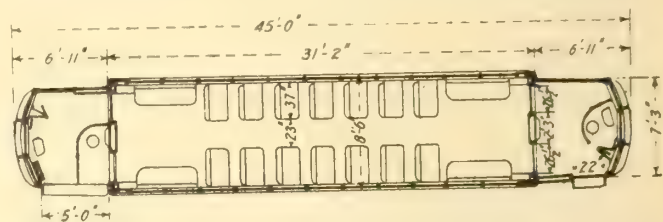
The end bulkhead doors slide into pockets and corner posts are divided to allow doors to slide to side plate of car, thus providing a clear opening of 48 in. in bulkhead

with doors open. A stanchion on platform with a railing around fare box divides the entrance and exit. The opening between body corner post and vestibule post is 61 in. wide and is provided with double two-leaf doors swinging inwards, the one on entrance side folding against controller and the one on exit side against ends of car body. A clear opening of approximately 24 in. and 30 in. is obtained for the exit and entrance. The steps are stationary.

Chicago Railways Co.

At the time this report was made, the Chicago Railways Company were building in their own shops 215 single arch roof p.a.y.e. bodies of the double end type. These cars are of lighter construction than those formerly built by this company, slightly shorter, and with platforms considerably smaller, being only 6 ft. 11 ins. from end of body to outside of bumpers. The seating arrangement, as shown, provides for transverse seats in the centre portion of the car with longitudinal seats for three persons on each side at the ends. The seating capacity is forty, of which twenty-eight are on transverse seats. The transverse seats are wide, measuring 37 in. over all, leaving a clear aisle space of 23 in. This width of aisle is considered rather narrow for the prepayment type of car but with the liberal width of seat there is less obstruction in the aisle, and the arrangement works out as quite satisfactory.

The platform arrangement is of the standard type with railing dividing the entrance and exit and a sliding door



provided which slides into a pocket at the motorman's right. The clear entrance at side of platform is 25¼ in. which is being increased on the later cars to 31¼ in. providing ample space for boarding. The clearance on exit side is the same on all cars, being 22¾ in. clear measure between railing and grab handle. The operating mechanism for the sliding door on front vestibule is manually controlled by the motorman. Steps of the folding type are provided at sides of platform so arranged that when those on one side are up, those on the opposite side will be down. Four inch safety treads are placed at the edge of wooden step treads. A metal moulding is installed at the outside edge of steps. The height from rails to first steps is 15½ in., from step to platform 13¾ in.

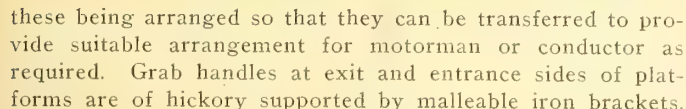
Chicago City Railway Co.

The standard car is of the double end p.a.y.e. closed type with the side sash in two sections, the bottom section arranged to raise, providing 26 in. clear opening with sash up. The later and what is considered the more up-to-date design is somewhat shorter and of lighter construction than was formerly used. The platforms on the later cars are 6 ft. 1½ in. long. Also a sliding door is provided in the bulkhead at the entrance side in place of a swinging door used originally, this latter being found objectionable with a crowded car.

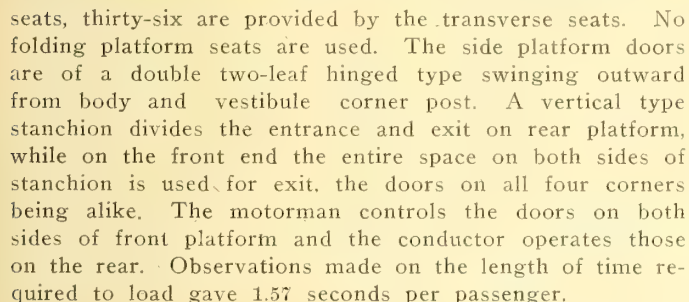
Steps are stationary in operation, but arranged so that the steps not in use will fold up. The steps on the two sides of the car are inter-connected so that when those on one side are folded up, the steps on the other side are down. The sliding door on the forward platform is manually operated by the motorman.

The car has a seating capacity of forty passengers, of

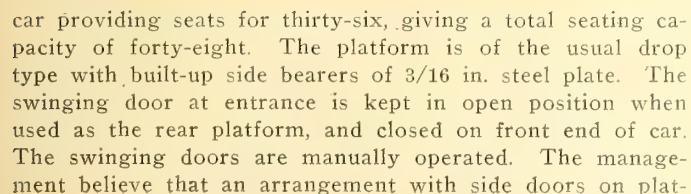
forms would be more satisfactory, due to fewer boarding accidents. Several of the older cars have been altered in this way. Bottom panels of doors are of glass.



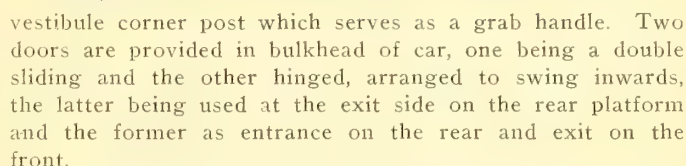
About one hundred surface cars used by this company are of the pay-within easy access semi-convertible type. The cars embody several unique features of construction. The seating and window arrangements are designed to provide for the maximum comfort of passengers consistent with a practicable, economical and substantial construction. Transverse seats of liberal width and spacing are provided in the centre portion of the car with a clear aisle of 25 in. Longitudinal seats are used at the end to give added space for incoming and outgoing passengers. Of the fifty-two



One hundred cars recently placed in operation by this company are the p.a.y.e. double end type with sliding doors in bulkhead and two-leaf folding doors swinging outward at the exit side of both platforms. Longitudinal seats are provided on each side at the ends for three passengers each and transverse seats are used in the middle portion of the

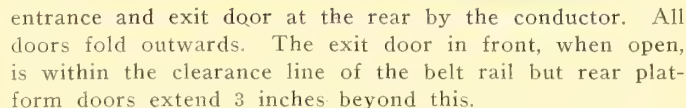


The car adopted as standard by this company is the p.a.y.e. Brill convertible type with combined transverse and longitudinal seats, the latter being placed at the ends to provide for necessary space at doors. The platforms are open at both sides and provided with vestibules of the portable type. The cars are arranged for double end operation, the platform on both ends being alike in arrangement and construction. A stanchion extending from bonnet bow to platform floor divides entrance and exit and a railing is provided extending from this stanchion around fare box and thence to bulkhead of car. There is also a stanchion at



The operating conditions in Baltimore are favorable to the use of a prepayment type car, density of population being lower than in other large cities. During rush hours, the average rate of loading is approximately $1\frac{3}{4}$ seconds per passenger. There were no signs of crowding or of passengers hurrying to gain entrance.

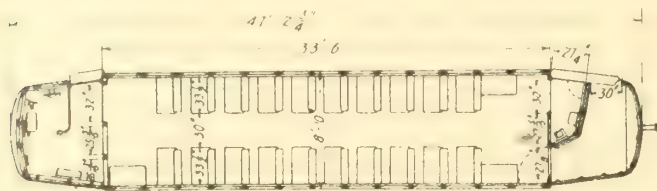
The standard car adopted by this company is of the pay-within type with bulkheads open almost the full width of car. This type has been adopted after having given the p.a.y.e. car a thorough trial, the latter being the first pre-payment type of car placed in service in Washington. The cars are arranged for double end operation with manually operated folding doors at sides of platforms, the exit at the front being controlled by the motorman and the combined



The seating arrangement is longitudinal seats at the ends seating four passengers on each side and cross seats in the remaining portion of the car. The total seating capacity is thirty-six. Account taken of the time required to load passengers gave 1.71 seconds per passenger on the average.

The latest type of car used by this company is for single end operation and for prepayment service, the prepayment feature being of the company's own design and

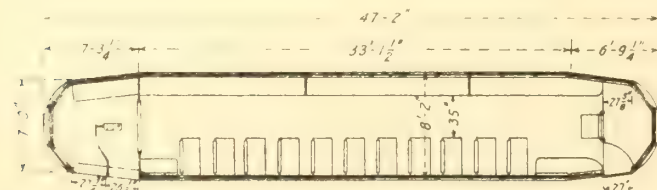
patent. The car has a total seating capacity of 46, of which 40 are on transverse seats, two short longitudinal seats for two passengers each being arranged at the rear end of the car and on one side of the forward end. A desirable feature of the seating arrangement is the 30 inch aisle. This is possible by the use of an extra wide car measuring 8 ft. 9 $\frac{7}{8}$ in. over the side posts. The rear platform is provided with a cab or enclosure for the conductor. This enclosure has hinged folding doors at the side of the platform for exit of passengers and balanced sash arranged to raise for the purpose of collecting fares at the entrance side. This compartment is open to the interior of car-body, a pipe railing being provided to partially divide the compartment from



the interior of car. A swinging door is used in the bulkhead on the entrance side of rear platform. This door has a clear opening of 27 $\frac{1}{8}$ inches when open and is arranged so as to swing both outwards and inwards. The rear platform, except for the small compartment for the conductor, is open with railing and dash iron at the rear of car and extending around the side of platform. The motorman's position is at the right-hand side of platform and a railing divides him from out-going passengers. The forward bulkhead of car-body is left open on the exit side and the side of platform is provided with sliding door manually operated by the motorman.

Pittsburgh Railways Company

The standard car is known as the p.a.y.e. type. It is arranged for single end operation with entrance at the rear platform only. Exit is provided both at front and rear platform, the latter having two pairs of doors placed at the side, operated independently or simultaneously as required, and so arranged that when both doors are open, a partition is formed, dividing the entrance from the exit. A sliding door operated by the motorman is used at the exit on front platform. One of the principal features of the entrance and exit arrangement of the Pittsburgh cars is the method employed for enclosing the steps when car is in motion. The steps at both the front and rear platforms are stationary, the doors extending down to them and being ar-



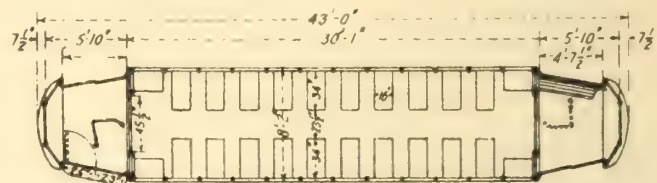
ranged so that when closed, they entirely cover the steps, being flush with the outside edge. The rear platform doors are manually operated while the exit door on front platform which is controlled by the motorman, is operated by pneumatic cylinder and piston mounted above the door. The air pressure is used to open the door only, the closing being effected by a long spiral spring which is compressed when door is open. These are devices invented by Mr. P. N. Jones, general superintendent of the system. The rear platform doors are each divided into two panels which open and close with a swivel motion and with a passenger on step would close behind him and tend to assist him in getting on car.

The car has a total seating capacity of fifty-six pas-

sengers, including four on rear platform. The seating arrangement combines transverse and longitudinal seats. A longitudinal seat extends the entire length of the car-body on one side and the transverse seats occupy the other side, together with short seats for two passengers placed longitudinally at each end. A single seat is also provided on front bulkhead of car-body in centre with back towards front vestibule. In the later type cars, a partition is placed at the end of the longitudinal seat behind the motorman.

Third Avenue Railway Company

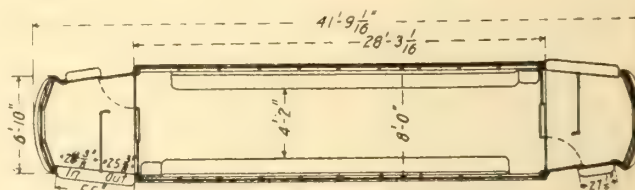
The standard car of this company is the p.a.y.e. double end convertible type. Cross seats are provided for forty passengers and short seats for two passengers each are arranged longitudinally in each corner of the car and a folding seat is used on front platform giving accommodation for three additional passengers and bringing the total capacity up to fifty-one. The platforms are of the usual drop type with step heights of 15 $\frac{7}{8}$ in., 13 in. and 9 $\frac{5}{8}$ in. respectively, beginning from the street. The standard p.a.y.e. platform arrangement is provided and cars are operated with one side of rear platform open and steps down. A stanchion from platform floor to hood divides the entrance and exit, a clear width of 25 inches being provided for the former and 23 inches for the latter. Sliding doors are located in



centre of bulkhead, no dividing post is used between the doors, but a stanchion is located about 6 inches from the bulkhead which serves as a division between the entrance and exit. This stanchion has been found objectionable and will be removed. The clear opening in bulkhead with doors open is 45 $\frac{1}{2}$ inches. A sliding door so arranged as to open by tripping a latch is provided for the exit on front platform. This door is under the motorman's control, the closing being effected by stepping on a foot lever pedal. This door is operated in conjunction with a folding step.

Washington Railway and Electric Company

Ninety-eight p.a.y.e. type are in service and three pay-within. The report states that the pay-within type has been found most suitable and will no doubt supplant the other

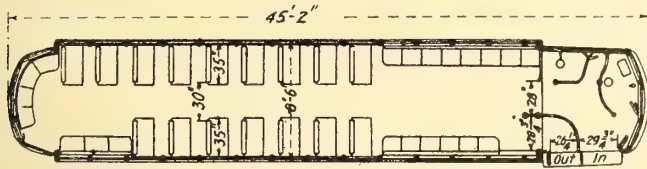


types for city service. The seating arrangement provides for use of longitudinal seats accommodating sixteen passengers on each side and one folding seat at sliding door which is not used at the front end. The length of the car over corner posts is 28 ft. 3 1/16 in. Cars are arranged for operation from both ends.

Philadelphia Rapid Transit Company

The type of car used by this company is known as the "near side" car, which, as the name suggests, is intended for operation where stops are made on the near side of the street. The conductor is placed on the front platform behind a dividing rail and both entrance and exit are pro-

vided for on this platform, the entrance being on the forward side and the exit near the end of car-body as indicated in the figure. The seating arrangement on the latest type of car used by this company involves the removal of the longitudinal seats indicated at the rear end of the car and installing in place thereof two transverse seats. The length of the transverse seat cushion is 35 inches. In the later designs further changes have been made with a view to lowering the steps, altering of grab handles to make them more accessible, providing better illumination of steps, in-



stalling hand straps the full length of the car, changing motorman's position to centre line of front window to provide a wider range of vision and installing short curtains in front of motorman, the step heights being reduced from 15 in., 14½ in. and 10¾ in. to 13 in., 13 in. and 10½ in., by sloping the car floor from bolster to end sill. A table is given, showing the length of time required to load the passengers, which works out on the average at 2½ seconds per passenger.

Centre Entrance Cars

Referring to the later type of centre entrance cars as used in Pittsburgh, New York and Washington, the report has this to say:—Side entrance cars are being considered by some roads and are used in Pittsburgh as trailers for which they are particularly adapted on account of entrance and exit both being located at centre of car, thus being under control of one man. This plant is also well adapted for non-prepayment cars as the conductor will never be more than half length of the car away from doors when collecting fares. On the pre-payment type of car the principal advantage in a side entrance arrangement is that with this plan the motorman will be relieved from controlling the exit door on front platform. On the other hand a centre entrance car will cause greater congestion at the doors thus making the duties of the conductor more onerous and producing a slower movement in the loading and unloading of passengers. The principal advantage claimed for centre entrance cars, like the one being tried out by the New York Railway Company, is in the elimination of steps. Without this feature the centre entrance car does not appear to have sufficient advantage over the regular drop platform type to warrant making such a radical change from existing standards, as any new cars purchased will, of course, have to be operated in conjunction with older equipment and the necessity for maintaining a uniform arrangement on all cars operated in any one locality is well recognized. A description with illustrations of the centre entrance cars being tried out in New York and Brooklyn was given in the Electrical News of May, 1912.

Obituary

On September 28th the waters of the Pigeon River, at Omemee, Ont., claimed the life of Mr. William McCaffrey, assistant manager of the supply department, Canadian General Electric Company, Toronto, together with his wife, his mother and his two children. Seldom has a more distressing fatality occurred. Spending the week-end at the home of his parents, Mr. and Mrs. Charles McCaffrey, of Omemee, the party went down the river in a 16-foot canoe for an afternoon outing. Exactly how the accident happened will never be known, but the bodies of the unfor-

tunate persons were discovered through the splashing of a 14-pound maskinonge still fast on a trolling line entangled with some of the bodies.

The number in the canoe now seems large, but this fact only reflects the fine character of William McCaffrey. Good natured, kind hearted, courageous, he would exert his powers to the utmost to provide enjoyment for the maximum number. An expert canoeist and swimmer, he anticipated no accident. Those who were intimate with William McCaffrey know what a battle he would make to save his family, but he had little opportunity, being handicapped in many ways. The shore on either side was a tangled marsh



The Late Mr. William McCaffrey.

of logs and weeds, through which even a person unhampered could not make way. When the bodies were taken out of the water, Mr. McCaffrey, his wife and little boy were all found together. The McCaffrey family have many friends, and sympathy is extended on all sides to the relatives of the five deceased persons.

William McCaffrey was well known in electrical circles. Born in Omemee in 1873, he received his early education in the Omemee High School, later entering the Peterboro Business College. After completing his course he was for a time with Hilliard & Peplow, millers of Peterboro, but for more than twenty years past had been associated with the Canadian General Electric Company, the last eleven years as assistant manager of the supply department. "I cannot pay too high a tribute to his splendid character and numerous manly qualities. I cannot begin to estimate his loss to me personally as a dear and valued friend and loyal associate, nor can we begin to estimate the loss of his valued services to this company," were the words expressed by his business associate, the manager of the supply department. He was well known as an athlete, a cricketer and a swimmer. A lover of honest sport, he was ever ready to assist in what was good and likewise to condemn any departure from fair methods. Two of his brothers are engaged in the electrical business, James, of the Canadian General Electric Company sales department, and Charles D., of the Toronto Hydro-electric System.

Negotiations are being carried on between the Hydro-electric department of the town of Galt and the Grand Trunk Railway Co. for the purchase of 200 horse power by the latter company, to run their cars between Galt and Paris.

Automatic Signalling and Dispatching

State of Indiana Approves System Adopted Three Years Ago by the Toronto and York Radial Railway Company—A Technical Description of the System

Recent legislation in the state of Indiana makes it compulsory that within a limited period a certain percentage of all the roads in that state, whether electrically or steam operated, must be equipped with some approved form of railway signalling and train despatching apparatus. Following this legislation a number of systems have been placed on the market and are being tried out in this state, three of which are said to be meeting, more or less, with the approval of the Railway Commission. To date however, only one system has actually been approved, the Simmen System, which has been installed on 18 miles of railroad of the Indianapolis and Cincinnati Traction Co. and is giving splendid satisfaction. This is the same system that was installed some three years ago on the Mimico division of the Toronto and York Radial Railway Co., a brief popular description of which appeared in the Electrical News of that date. Recent improvements and the revival of interest in this type of equipment due to the action of the Indiana state authorities have started further inquiry into the subject and the present article contains a more technical description of the equipment and of the workings of the system.

The Simmen System of despatching provides for an automatic record of the train movements in the despatcher's office in graphic form together with switching equipment by which the despatcher can signal "danger" or "clear" indications to engineer or motorman direct in his cab. Direct telephone communication between motorman and despatcher is also provided. Additional protection which may be desir-

able and justifiable for heavy or high speed traffic such as automatic block, track circuits and automatic stop can be added from time to time and made to fit in and work as auxiliary to this system without prohibitive complication.

The system is claimed to render possible quicker train movements to an extent equal to placing telegraph operators at every passing siding on a single track road, or block station on a double track road. The time requisite to deliver instructions through a third party is therefore saved. The despatcher and engineer are protected against error by automatic devices and the entire system is so designed that any failure in the equipment will result in danger signals. As 50 per cent. more trains can be handled over a single track road this may often result in postponing the double-tracking of a line for years.

The Automatic Record

The automatic record in the despatcher's office serves two purposes. It gives the despatcher the fullest possible knowledge as to the whereabouts of all trains, and enables him to direct very perfectly all train movements. In addition to this, it serves as a permanent recording of many important acts of the train crews such as a train running behind or ahead of schedule; the speed maintained through any block; length of delays; the efficiency of the despatcher in directing train movements, etc. This information is all recorded in graphic form and a few minutes perusal, by the superintendent, of each day's record will enable him prac-

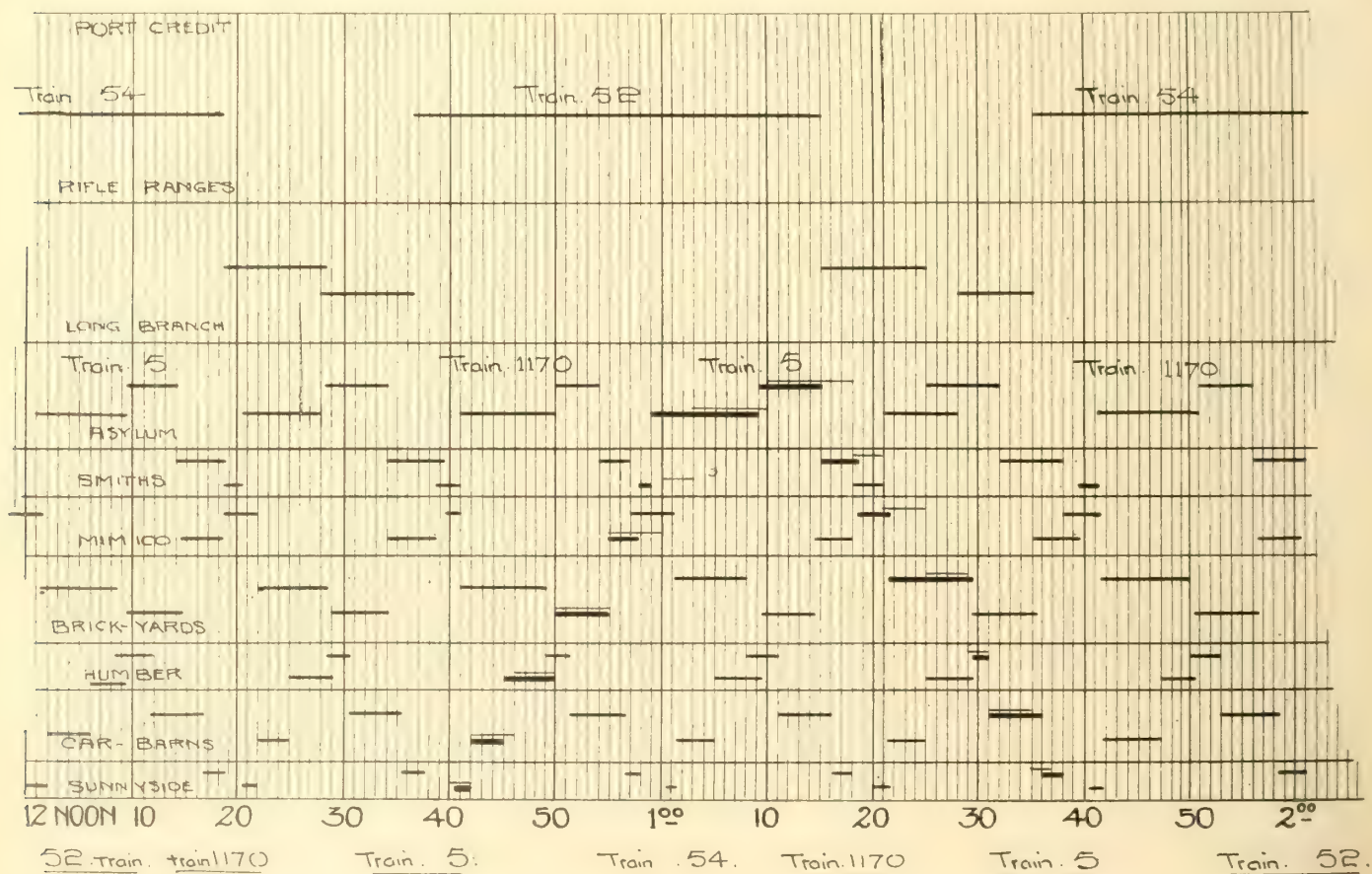


Fig. 1.—Fac-simile reproduction of automatic record made in despatching office

tically and accurately to correct any weakness in his organization.

A despatcher's recording sheet is shown in Fig. 1. It is divided into time lines (vertical) in one direction and block lines (horizontal) in the other direction. The distances between horizontal lines are intended to correspond approximately to the lengths of the blocks.

Each day a new recording sheet is placed upon the despatcher's recording table. The recording table is provided with clock work for continuously moving the sheet and with electrically operated perforating needles. Two such perforating needles are provided for each block, one recording east-bound movements and the other west-bound. The re-

Number 5 is next shown entering the Mimico block on time and Smith's block two minutes ahead of time. At this point also, a train, number 170, is met, which arrived at the meeting point one minute ahead of number 5. Number 5, continuing, enters the Asylum block four minutes ahead of time and arrives at Longbranch one minute ahead of time. This is the destination of train number 5, which now returns to Sunnyside.

The east-bound record now begins showing number 5, after starting its return trip one minute ahead of time, as spending six minutes longer in this block or 16 minutes altogether. On the return journey, Smith's block was reached 3 minutes ahead of time, Mimico block $2\frac{1}{2}$ minutes ahead of

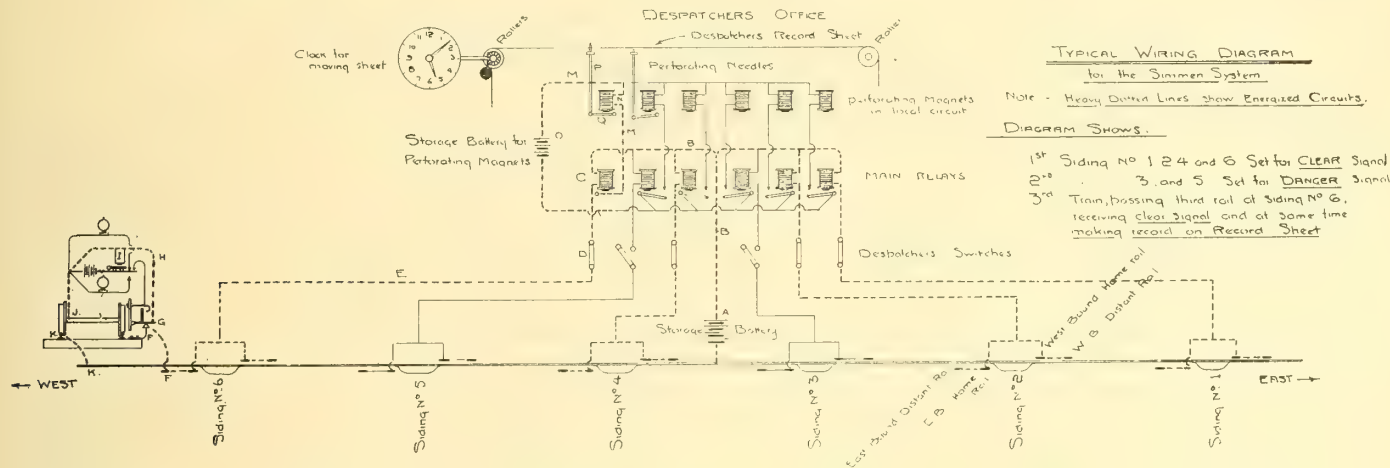


Fig. 2.—Wiring diagram of the Simmen System of automatic control

cord sheet, when placed, is regularly and continuously moved by clock work, so that the correct time line as marked on the sheet, is always directly under the perforating needles. Fig. 1 is a reproduction from an actual train record sheet. A twenty minute schedule was in operation for a portion of the road and an hourly service for the whole distance. The short horizontal lines on the lower side of the block spaces in Fig. 1 represent west-bound records; the upper lines represent east-bound or return journey records.

That the chart may be more readily understood the actual record lines of train number 5, leaving Sunnyside at 12.40, have been shown by heavier lines. For comparative purposes the schedule times are also shown in faint line beside the actual record lines, so that the discrepancies between those two will indicate the extent to which the car was ahead of or behind schedule time. The instant the car enters any block, the proper needle automatically commences to perforate the sheet exactly as shown by these record lines and continues to make these records as long as the car remains in the block. It will be seen throughout this whole chart that west-bound trains record their movements diagonally in a north-eastern direction (as on a map) while east-bound records follow one another in a south-easterly direction.

Following the heavy lines spoken of above, it will be seen that number 5 left Sunnyside a half minute late and entered the Car Barn block on time; entered Humber block one minute ahead of time, and Brick Yard siding on time, 12.50. The record shows that at this point, car number 54 was met coming in the opposite direction where an overlap of time is indicated showing that number 54 arrived at the meeting point one minute ahead of number 5.

Number 54 would here send in a report by telephone to the despatcher, which would be followed by a report from number 5 on its arrival one minute later. The despatcher would then give a "clear" signal to both trains which would proceed in their proper directions,

time, Brick Yards $3\frac{1}{2}$ minutes ahead of time, Humber $\frac{1}{2}$ minute behind time, Car Barns on time. Sunnyside was finally reached one minute late, the block having been entered just that amount behind time.

In a similar way, the course of any train throughout the day is shown at every instant of the day and is filed for future reference.

The Automatic Equipment

Fig. 2 is a typical wiring diagram for the system, and shows the method of recording and signalling at every siding along the road. Electrical contact between the car and the despatcher is made through a third rail which engages with a 'shoe' projecting from the side of each car. Current passes from this shoe through the necessary cab equipment to the regular track rails, by way of the car wheels. The third rails are insulated from the tracks and ground but are interconnected in pairs, as shown in Fig. 2, and electrically connected by separate wire with the despatcher's office. There will usually be four third rails, two for east-bound and two for west-bound traffic. The length of the rails will depend upon the speeds to be attained on any particular road. For faster traffic they are from 70 ft. to 80 ft. long. One form of third rail construction is shown in section in Fig. 3. In practice one rail is placed near the beginning of a block and is known as the home rail, the other is placed a couple of thousand feet back from the beginning of the block and is known as the distant rail. These are indicated in Fig. 2.

Each car is provided with a shoe which makes an electrical contact with the 3rd rails when sliding over them. When a shoe is in contact with a 3rd rail, the open circuit (normally) between the 3rd rail and track is closed, the closed circuit then running from 3rd rail through the contact shoe and apparatus on cab to a ground return on the track and track rails. The third rails at each siding are connected direct to the despatcher's office and to one side of the despatcher's switch. From the other side of the despatcher's

switch a wire B connects through the winding of the main relay C to one side of a storage battery A, the other side of which is connected to track rails K. The instant a contact shoe of a train makes contact with a 3rd rail a circuit is established as follows, Fig. 2:—From a storage battery A, through wire B, through relay C, despatcher's switch D,



Fig. 3.—One form of third rail construction

wire E, 3rd rail F, contact shoe G, signal relay on cab to ground K, back to despatcher's battery A.

The closing of this main circuit energizes the main relay C, which in turn closes a local circuit through the perforating magnet N. The magnet N becoming energized, pulls up its armature Q which forces the perforating needle upwards and makes a record on the despatcher's sheet. To give continuous perforation as long as the train is in the block, a polarized relay is used, not shown in the drawing.

Signalling Equipment

The underlying principle of the cab signal is that, if a 3rd rail is electrically energized, a train in passing will receive a "clear" signal. If the 3rd rail is de-energized, a "danger" signal is displayed. Further, a "clear" signal re-

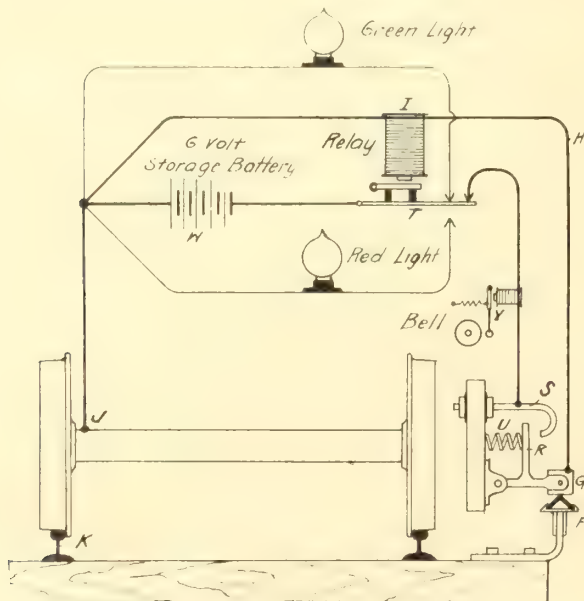


Fig. 4.—Showing cab signal circuit

ceived on entering a new block will continue to show "clear" throughout the block and a "danger" signal once displayed will continue at "danger" until it is automatically cleared as a train is passing an energized 3rd rail. Either a "clear" or a "danger" signal is always in evidence every foot of the way. The cab signal circuit is shown in Fig.

4. When the contact shoe G meets the third rail F, the shoe is raised and the arm R is separated from the front stop S. If the third rail is energized the circuit is established through the third rail F, the shoe G, the wire H, the signal relay I, to earth J, and track K, thence completing the circuit through the despatcher's office as described above. With this circuit energized the relay I draws the armature T, closing the contact through the green or "clear" signal lamp as well as the other circuit to front stop S. As soon as the shoe leaves the 3rd rail, the spring U forces the contact arm R against S, closing a local circuit through G, H, I, storage battery W, T, S, R, back to G; in this way a "clear" signal is continued through the entire block.

When a car passes a de-energized 3rd rail, the contact shoe is lifted, the arm R separates from S, breaking the local holding circuit and cutting out the battery W. The relay I becomes de-energized, the armature T drops and

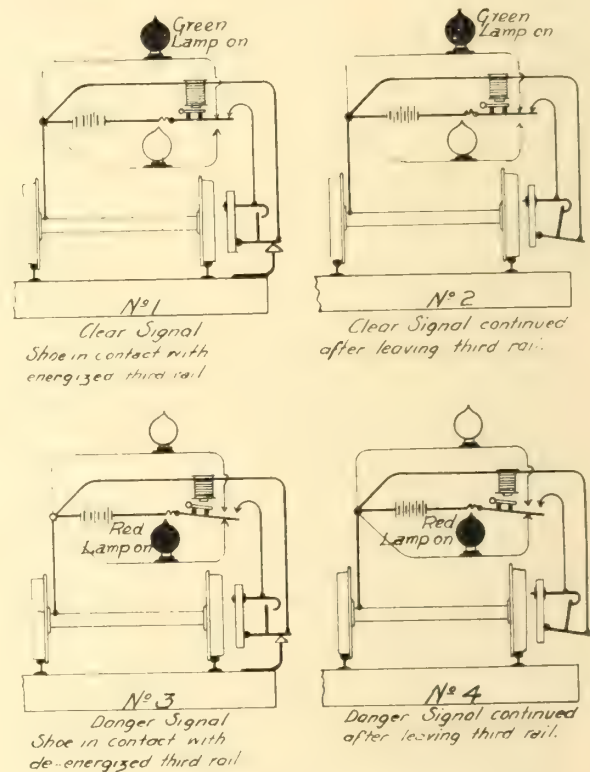


Fig. 5.—Showing cycles of signal circuit

closes the local circuit through battery W, and the red lamp. This is the "danger" signal which remains throughout the block because contact cannot be broken except by energizing I, which only results when the 3rd rail F is energized by the despatcher.

The four cycles of the cab signal "clear signal on 3rd rail," "clear signal after leaving rail," "danger signal on rail," and "danger signal after leaving rail," are illustrated in Fig. 5.

By reference to Fig. 2, it will now be understood that sidings 1, 2, 4 and 6 being energized are set for a "clear" signal while sidings 3 and 5 being on open circuit are set for "danger" signal.

It will be seen that this system requires as many complete circuits passing through the despatcher's office as there are sidings. The rails are generally used for common return, though it may often be found more satisfactory to install a heavy return cable.

The Western Foundry Co. has recently installed a 175 kw. a.c. 3 phase, 2,200 volt generator of the Swedish General Electric type. The factory is located in Wingham, Ont.

Developments in the Railroad Field

Within the last twelve months there have been a number of developments that are important and that have contributed greatly to the high state of perfection that electric railway engineering has already reached. The developments include more attention to the economic side of railway operation, car and locomotive equipments, improvements in generating and converting apparatus and in details. A recapitulation of some of the important advances is given below.

High-Voltage Direct-Current Traction

The high-voltage direct-current system for railway service is a development due to the advisability of retaining the direct current series motor, which has been found so satisfactory on low-voltage work, and to the facility with which this motor can be operated over 600-volt trolley lines in towns and cities. In some cases, this system is also applied to advantage where the available power is 60 cycles, alternating-current, and where high voltage is not permitted through small towns. With the single-phase system these conditions would necessitate the introduction of frequency changer stations and also transformer stations to reduce the voltage in the towns. Furthermore, the high-voltage, direct-current system can be installed as an addition to the present 600-volt system, which is a decided advantage for interurban work. A 1500-volt trolley can be used over the interurban sections which permits the retention of smaller city cars of the 600-volt service. It also permits the retention of the direct-current series motor to a much greater extent than does the single-phase system, and in this way fills the gap which previously existed between 600 volt service and the high voltage systems.

High Voltage D.C. Generating Apparatus

Due to the rapid and wide application of high voltage direct current, generating and converting apparatus has been developed to a high degree of perfection. Either motor-generator or rotary converter sets are used for supplying the high tension direct-current.

High Voltage D.C. Substations

The equipment that was recently placed in operation by the Piedmont Traction Company is of particular interest because the voltage of 1500 is the highest direct-current pressure ever used in this country for electric traction. The property is also of interest because the energy is not generated by the Piedmont Traction Company, but is supplied from the Southern Power Company's lines through nine substations. In so far as possible duplicate equipment is used in all of the stations. The 1500-volt direct-current is obtained by arranging two 750 volt direct-current generators in series. All of the motor generator sets are exact duplicates and each consists of two 250 kw., 750-volt, direct-current generators driven by a 750 h.p., three-phase, 60-cycle, 2400 volt synchronous motor. A $6\frac{1}{2}$ kw., 125-volt, direct-current exciter for the synchronous motor is mounted at the end of the shaft. One 500 kw., direct-current unit has been installed in six of the stations and two 500 kw. units have been installed in three of the substations. The energy is taken in one case from a 13200 volt line and in one other from a 44,000 volt line which is fed through step up transformers from a 2200 volt line. In all of the other substations energy is taken directly from the 2200-volt lines and in every case the voltage on the motors is 2200.

High Voltage D.C. Switching Apparatus

The switching equipment, for so called high voltage

direct current railway work in general follows the conventional lines developed for standard railway practice, using approximately 650 volts. Departures are found in the removal of all live parts from the reach of attendants, and in the provision of extra heavy insulation for instruments, rheostat handles, etc. The breakers for 1500 volt service are essentially the same as for 650 volt work, save that they are modified to give a longer opening, and trip free from the handle. Barriers are provided between adjacent breakers in order that no possibility of communication between them can occur at the time of opening heavy short circuits. The breakers are placed rather higher than usual and instead of being operated directly by hand, a handle and operating rod, similar to that usually found with oil switches, are used. A like arrangement applies to the knife switches which are mounted also high up and at the rear end of the board. The wooden operating rods between the handles and the switches or breakers afford liberal insulation. All high voltage bus bars are carried at the top and behind the switchboard.

High Voltage D.C. Motors

The armatures are especially designed to withstand the higher voltage, being well insulated, and having liberal creepage distances provided at each end of the commutator. The brushholders have extra heavy porcelain insulators. The length of the dust ring at the end of the commutator and the clearances from the live parts of the motor to the ground are greater than in ordinary designs. The axle bearings are provided with dust guards to prolong the life of the bearings and gearing, while the motor itself is entirely enclosed. One large manufacturing firm outlines the important features of this motor as follows:

1. Sparkless commutation under all loads and voltages encountered in service.
2. Oily waste lubrication—separate gauging oil reservoir—filtered oil.
3. Strap-wound armature coils.
4. Spider armature construction.
5. Bolted commutators.
6. Strap-wound field coils.
7. Spring packed field coils.
8. Thoroughly insulated and accessible brushholders of superior type.
9. Gear case suspension of proven superiority.
10. Axle caps and axle bearing dust guards.

The B. C. E. R. is the only Canadian company using a higher voltage than 600.

Novel Car Designs

Philadelphia, New York, Brooklyn and Pittsburgh have been favored with radical departures in car construction, and the general characteristics of the cars embodying this construction are outlined below.

Philadelphia Near Side Car.—The Philadelphia Rapid Transit Company have in operation "Near Side" cars. These cars are for the city service, being 45 ft. 2 in. long, seating 54 people, and weigh 39,000 pounds equipped, without passenger load. The weight per seated passenger is 723 pounds.

New York Stepless Car.—A very novel type of car has been brought out by the J. G. Brill Company for the New York Railways, known as the Stepless car. The car is of the center entrance type, 40 ft. 8 in. long, seats 51 people and weighs 37,000 pounds equipped without passenger load.

Brooklyn Center Entrance Car.—Also a center entrance car known as the Brooklyn Center Entrance Car was recently

introduced by the Brooklyn Rapid Transit Company. This car is 45 ft. 6 in. long and weighs 638 pounds per seated passenger.

Light Weight Motor for Pittsburgh Railways

As a result of the efforts of car designers to construct light weight city cars, it followed naturally that efforts would be made toward reducing the weight of electrical equipment and trucks, and recently a light weight motor (four of which will propel the lightest weight per seated passenger, double truck cars ever built) has been developed by the Westinghouse Company for the Pittsburgh Railways Company. The car is 45 feet over all in length; weighs 33,750 pounds completely equipped, and weighs 478 pounds per seated passenger. To date, this is the lightest weight per seated passenger, double truck trolley motor car ever built.

Instead of using 30 or 33 inch wheels, as is usually the practice with city cars, the new Pittsburgh car employs 24-inch wheels, and thereby effects considerable saving in weight. Because wheels not smaller than 30 inches have ordinarily been used for city service, it has been the practice of motor manufacturers to design their machines as to be accommodated in the clearances provided by a 30-inch wheel. The introduction of the 24-inch wheel by the Pittsburgh company necessitated the development of a very compact motor of an entirely new design, which could be accommodated by the clearances afforded by the small wheels. The new motor is of what is humorously termed the "dachshund" type, since its general appearance is similar to that of a certain breed of canine. The motor is long and drawn out along the shaft, and small in diameter. This attenuated feature of construction was necessary in order to obtain space for the material required for a motor of the desired capacity, since the maximum diameter allowable for the motor was restricted by the small diameter (24 inches) of the car wheel. The nominal rating of the motor is 30 h.p. at 500 volts with a draught of 58 amperes.

Field Control

One of the most important recent developments is the use of a field control effected by employing motors having a greater number of turns in the field winding than is ordinarily employed, and by arranging the control so that on certain notches a portion of the field winding is cut out of circuit. Two important advantages of field control are:—saving in power consumption and flexibility of equipment for service, (the same equipment being adaptable to city and suburban running and also to local and interurban running). When the entire field winding is used, the motor can produce large tractive efforts at low speeds with the moderate current input. This enables it to start and accelerate the car very economically. When a portion of the field winding is cut out, the characteristics of the motor are modified just as if the gear ratio had been instantaneously changed. When connected in this way, the motor attains higher speeds than with the full field winding in use, and while the "normal field" is not so well adapted for starting the car, it is much better adapted for producing a high maximum car speed. In this way a given equipment can be made to operate more nearly under ideal conditions both in starting and in free running than if it must be arranged on some compromise basis.

This arrangement is particularly advantageous for city and suburban service where a large number of service stops are made, and under such conditions there is claimed to be, with field control, a saving of 15 to 20 per cent. in power consumption. Field control is also advantageous for interurban equipments which are sometimes operated in local and sometimes limited service. Its use in such cases en-

ables a single motor equipment to be readily arranged so as to give good results, in both classes of service.

Portable Railway Substations

Portable substations are being extensively used by a number of U. S. electric railways. Some of the principal uses to which a station of this kind can be put are:—To be used as spare equipment; to help in locating the most advantageous place for a permanent substation; or to help carry an unusually heavy load.

Commutating Pole Rotary Converters

Commutating poles as applied to rotary converters fulfil the same functions and result in the same advantages as in their more familiar applications to direct-current generators and motors. That is they incur sparkless commutation with a fixed brush position from no load to heavy overloads. Commutating-pole rotary converters for railway service are normally arranged for automatic compounding through the position of a proper combination of series excitation and of inductance which is included between the generator and rotary converter. Since commutating-pole rotary converters are operated with the brushes in a fixed position corresponding to the no load neutral, the brushes are not shifted when this position has once been determined. Hence machines of this type are not provided with a brush shifting device. The alternating-current method of self starting rotary converters is recommended, and for the successful operation of commutating-pole rotary converters requires that the direct-current brushes be lifted from the commutator during the starting period. A simple, rugged, convenient arrangement known as the brush lifting device raises all the brushes but two which act as pilot brushes.

28,000 H.P. Steam Turbine

The firm of Escher Wyss & Company, Zurich, Switzerland, has recently delivered to the Rheinisch-Westfälischen Electric Generating station in Essen the most powerful steam turbine ever built. When running at a speed of 1000 revolutions per minute it develops 22,500 h.p. under normal continuous working, with a pressure of 150 lbs. per square inch gauge, a steam temperature of 572 deg. F. at the stop valve and a vacuum of 27.5 inch (a higher vacuum cannot be obtained owing to the fact that only re-cooled water is available for the condenser). The turbine is also capable of developing 28,000 h.p. continuously and 30,000 h.p. for short periods. The turbine is of the standard "Zoelly" type. The machine has 14 runner wheels, mounted on a strong steel shaft, the total weight of the rotor being 26 tons. The total weight of the generator rotor (Siemens Company's make) approximates sixty tons. The two rotors coupled together are supported by four bearings being supplied with about 130 gallons per minute of oil for lubrication. This oil is under pressure produced by a pump driven from the main shaft. During the period of starting the main unit the oil pressure is produced by a small centrifugal pump connected directly to a separate tiny steam turbine. When the main unit has attained full speed, this auxiliary turbine is shut down. The oil is conducted from the bearings to an oil tank, where it is cooled down in solenoids of copper, and is then pumped back to the bearings. The oil is consequently used over and over again and only from time to time a small quantity is needed to replenish the supply. The exhaust steam is led through a branch of eight feet diameter to the surface condensing plant, located beneath the turbine, the cooling water being supplied from a cooling tower. A separate turbo-pump then delivers the condensed steam into a hot well, from which the water is in turn delivered to the boiler feed pump.

The Kearney High-Speed Railway

Among the numerous so-called Monorail systems which have been patented from time to time, the one which appears to have attained the greatest success and which now shows the greatest promise of ultimate usefulness, is the Kearney High-Speed Railway System. In this system the cars run upon a single bearing rail which takes the whole of the weight of the train. The cars are maintained in an upright position by means of a single overhead guide rail rigidly supported by standards placed at intervals of about 60 feet. With this equipment derailment is physically impossible unless an actual breakage of the permanent way occurs. The centre of gravity of the car is low so that the pressure of the guide wheels amounts to only a few pounds when the car is at rest, and to practically nothing when the train is running at speed on a straight line. On curves where an appreciable stress is put upon the top rail special care has been taken to allow a high factor of safety and it is claimed that as compared with the ordinary steam or electric road that the factor of safety of the Kearney equipment is three times as high as that of the ordinary equipment. The system is applicable to single line or double line construction on the level, for elevated roads, or for subways. A double track construction costs much less than twice as much as a single track construction on account of the over head supports

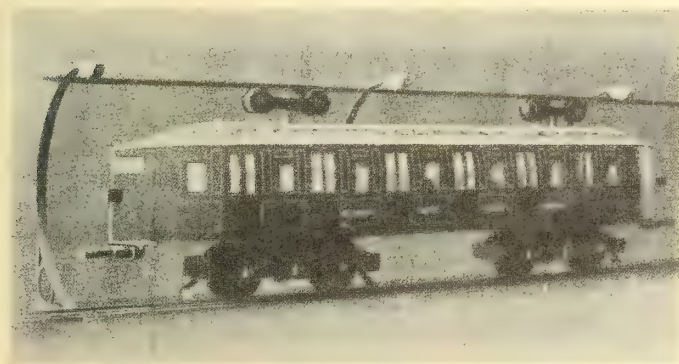


Fig. 1.—Car in operation

which must be installed for a single line and which with a simple modification are suitable for a double track.

The cost is estimated to be considerably less than the cost of standard railways. Using 70-lb. rails both above and below, the complete cost per mile of line is estimated at \$30,000, which includes construction and all equipment to the line ready for running as far as the permanent way is concerned. It is claimed also that much higher speeds can be obtained with safety than on the ordinary roads, actual tests showing that up to 150 miles per hour would not be attended with any danger.

As a solution of the transportation requirements in large cities, the Kearney system appears to offer the greatest promise. As planned, the underground system using the Kearney car will be known as the gravity system. According to plans, platforms will be constructed immediately below the street level and intending passengers will merely have to walk down a short flight of stairs. Leaving the station, the train will run down a gradient of one in seven so that in about 210 yards, representing 19 seconds in time, the train will reach a depth of 90 feet below the station level and be travelling with a velocity of fifty miles per hour. Supposing the stations to be 1,100 yards apart, the train will now run along a level stretch of line for a distance of about 600 yards and maintaining the speed of fifty miles per hour will cover this distance in twenty-four seconds. The incline to the next station will be similar in every respect to the decline on leaving the last station. During the 19 seconds

required for this distance, the train will be losing speed at the same rate as it originally acquired it, the inertia of the train being sufficient to bring it up to the station platform if the power is shut off just at the instant the incline is commenced. The cost of constructing and equipping this type of underground railway, using a single tube between

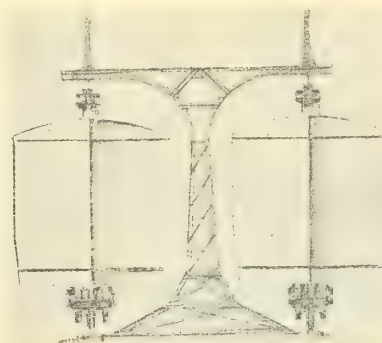


Fig. 2.—Cross section of double track line

stations, is calculated not to exceed \$1,250,000 per mile.

As a result of negotiations extending over several years, valuable concessions have recently been obtained for a railway to be built on the Kearney system between Nice and Monte Carlo. This high-speed line will start from Nice as a gravity tube railway and will continue in a tube to the outskirts of the town, a distance of one and a quarter miles. For the next nine miles the line will be a surface railway, following as far as possible the contour of the country. The line will again enter a tube three-quarters of a mile from the Monte Carlo terminus. It is anticipated that the first section of this railway will be ready for traffic before the end of 1913.

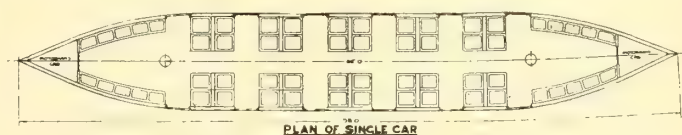


Fig. 3.—Plan of Kearney car

The accompanying illustrations represent views of the Kearney cars. The first car was recently turned out by the Brush Electrical Engineering Company at their works at Loughborough. The general dimensions are, length 45 ft., width 8 ft., with 7 ft. 6 in. head room. The car has seating accommodation for 45 people.

New Companies

Structural Engineering Company Limited has been incorporated with a capital stock of \$50,000 to carry on business as consulting engineers, architects, steel and concrete workers, &c., with head office at Montreal.

International Engineering Works Limited have been incorporated with a capital stock of \$1,500,000 to carry on business as mechanical, electrical and hydraulic engineers, &c., with head office at Montreal.

Toronto Electric Motor Car Company, Limited, has been incorporated with a capital of \$300,000 to manufacture and deal in motors, engines and propellers of all kinds, with head office at Toronto.

Electrical Utilities Company, Limited, has been incorporated with a capital of \$50,000 to manufacture and deal in electrical appliances and products of wood and iron, with head office at Toronto.

The Pacific Province in Gay Attire

The "Connaught"

In connection with the recent visit of His Royal Highness, the Duke of Connaught, and party to Vancouver, the B. C. Electric Railway were requested to arrange for the transportation of the royal party from Vancouver to New Westminster on September 21st. In order to meet the demands fittingly, the company decided to equip one of their



Interior of Connaught car

cars as a royal car, and this work was handsomely carried out in the company's shops. A view of the exterior and interior of this car is given herewith. His Royal Highness was greatly pleased at the forethought and care of the company for his accommodation and so expressed his feelings to the management.

The car used for the trip was one of the regular cars built for the Fraser Avenue division of the company's lines. The interior fittings were entirely taken out and a re-arrangement in parlor car style installed. The interior trimmings were of rich green and cream, the company colors, relieved by light silk curtains at the windows, the carpeting being in green and the chairs and lounges in green plush. The car was equipped with frosted lights and, as a portion of the run was in the evening, electric luminous radiators provided the heating. The exterior of the car was painted in green and cream, the name "Connaught," and the Royal Coat of Arms appearing on either side.

Kamloops

The sum of \$237,600 was recently appropriated by the city of Kamloops for the construction of a hydro-electric power plant at Barrier River, a tributary of the North Thompson River, the distance of transmission being about forty miles from Kamloops. The work will consist of building an intake dam and three and a half miles of flume with about 500 feet of steel penstock. The plans call for the immediate installation of equipment capable of developing 2,000 horse power with provision to increase the capacity of the plant by adding further units to as high as 10,000 horse power. The power generated will be used for city requirements, including lighting, pumping for the water supply, and ordinary power purposes, and in addition will supply power along the transmission lines to lands requiring irrigation by pumping from the North Thompson River. It is expected that considerable revenue will be derived from this latter source.

A steam plant reserve will also be immediately constructed with initial capacity of 1,000 horse power, and will include in the equipment a 500 kilowatt steam turbo-generator set, and a 200 kilowatt tandem compound engine generator set already in service in the existing plant. There will also be installed two 1,200 gallon per minute centrifugal pumps operating against 300 foot head, driven by induction motors. This plant will cost in the vicinity of \$125,000, including land for the site. It is intended to so design the plant that provision will be made for a filtration plant to be used in conjunction with the water supply. The plant will connect up with the concrete reservoir already completed at a cost of \$35,000.

Messrs. Dutcher-Maxwell Company, Vancouver, are consulting engineers on the entire work, and are associated with Mr. R. S. Lea of Montreal.

Tenders have been called for the installation of ornamental lighting on Harris street, Hastings street east, Granville street south, and Main street, Vancouver. Steel armoured cable will be used on these installations in lieu of conduit and lead covered wire. It is expected that this method of construction will reduce the cost about twenty-five per cent.

Work has been started on the installation of ornamental lighting on Robson street, Vancouver. This installation will consist of sixty-six five-light cluster standards and it is expected that they will be in operation before December 1st.



Car specially fitted out by the B. C. E. R. Company for the Royal Party's use

A Special Appeal for Caution

The British Columbia Electric Railway Company have recently placed in the cars on their system a new style of "caution" card. It was considered by the management that the ordinary "Stop, Look, Listen" card should be improved so as to better attract public attention. The plan finally accepted was the selection of an owl as an emblem. A half-tone from a photo of a real bird was prepared, this



occupying the centre of the card. Above the owl are the words—Passengers Be Wise. On the owl's breast are the words—Stop, Look, Listen—and on either side of the bird are the customary notices—Wait until the car stops—and—Car Coming on Other Track. The card is provided in black, red and green and has attracted considerable public attention by reason of the novelty of the appeal for caution.

Folders Explain Large Bills

In common with other companies furnishing electric light for residential use, the B. C. Electric Railway Company is troubled every fall, year after year, by patrons who cannot understand the increase of their bills during the fall months over the amount paid during the summer. To meet this difficulty the company will, during October and November distribute to its patrons two folders giving the natural reasons for the larger bills during the fall and winter months.

One of these folders contains a chart on which is noted by squares of comparative size the relative number of hours of sunshine for the various months of 1911, the statistics

on which the chart is based having been obtained from the reports of the Meteorological Bureau. This showing takes into account the varying length of the day as well as the prevailing fog, cloud and rain, thus covering all conditions tending to the increase of lighting bills. The comparative squares are shown in parallel columns which places the January showing above July and the December below June, the result being to give at a glance a clear idea of the reasons for the variation of lighting bills.

The second chart covers the relative amount of daylight during the various months of the year, notation to darkness and daylight being given by ruled and blank surface for each month, the relative number of hours of daylight and darkness being noted above the spaces.

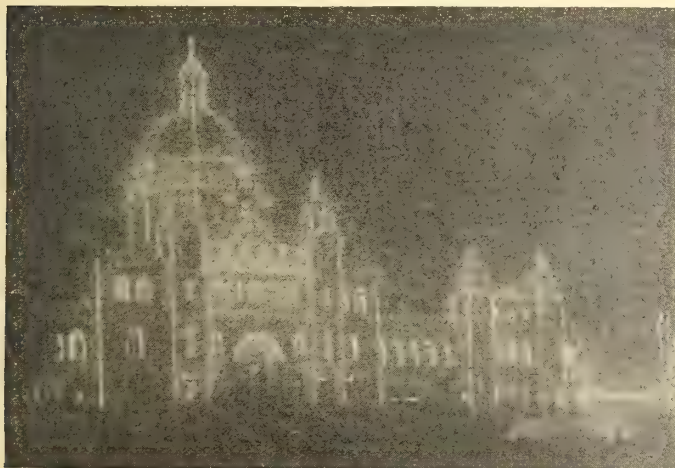
In addition to the distribution of folders containing these charts and accompanying explanation with the monthly bills, the company has had large charts prepared, which will be framed and hung at the cashier's wicket and other parts of the building where the public gather to pay their lighting bills.

Illumination for the Royal Visit

The visit of His Royal Highness, the Duke of Connaught, Governor General of Canada, and his party to Vancouver was the occasion of a welcome which evidenced the loyalty of the residents of the metropolis of the Canadian Pacific Coast. Electric illumination played a prominent part in the celebrations which continued over four days.

The most prominent illumination was that given at the new office building of the B. C. Electric Railway Company at Carrall and Hastings streets, in the centre of the city, a view of which is given in connection with this article. In carrying out this lighting scheme over 5,000 lamps were used. The general plan followed was an outlining of the building, as indicated by the view, with a cascade of three rows of lights from the flag-staff to the roof. For the outline strings, four candle power lamps were used and the effectiveness of the display was greatly increased by the row of 40-watt tungsten lamps, located under the coping of the cornice of the upper storey, these forming a part of the permanent wiring system of the building. On the ground floor the building was surrounded by a row of 12 regenerative flame arcs, placed between each of the arches on the street frontages. On the Hastings street side, a special design of a crown in which 200 lamps were used, some being in color, and "God Save The King," in letters two feet high, made an effective addition to the display.

In the business section of the city twelve handsome arches were erected by various semi-public organizations, the majority of which were illuminated at night. The B. C.



Parliament Buildings, Victoria, B. C.



Hastings Street from Granville Street, Vancouver, B. C.



B.C.E.R. Block, illuminated for Royal Visit

Electric furnishing free current for this purpose. A view of the illuminations on Hastings street, from Granville, is shown. The illuminated arch in the lower right hand corner is the "welcome" arch of the city, and the large building in the left foreground is that of the Canadian Bank of Commerce. The arch in the centre of the picture is that of the Canadian Northern Railway, through which may be seen the lights of the largest of the arches, that erected by the Italian residents of Vancouver. The Hastings street view is an illustration of the handsome illuminations prevailing in Vancouver during the nights of the Governor General's stay.

B. C. E. R. Social Club

The management of the B. C. Electric Railway Company recently appointed a committee to consider the question of the organization of a B. C. Electric Social Club, composed of the staff of the head office in Vancouver. This committee has been at work for some time and recently reported that the Club project had received good support,



Parliament Buildings, Victoria, during Royal Visit

250 employees having signified their intention of becoming organization members. The management of the company intend that the new club shall assume the direction of all the social and educational features of the company's work. For the present year the control of the organization will be under the committee appointed by the company, but at the first of next year the members will elect their own officers.

The company has granted the club the use of the upper floor of a large block just in the rear of its new terminal station and adjoining the head office. Here four rooms will be provided, each 17 by 56 feet in size, which will be fitted up as Social Hall, Billiard Room, Game Room and Reading Room. For the alteration of the building and furnishing of the rooms, the company has generously made a grant covering the entire cost, thus enabling the club to be conducted on a scale of dues which is very low and which is based in proportion to salaries received. Work on the club quarters is now in progress and the committee hope that the organization will be in operation during the early part of November.

Elected Officers

The annual meeting of the B. C. E. Section of the N. E. L. A. was held on Oct. 2, the following officers being elected for the ensuing year: Hon. president, R. H. Sperling; presi-



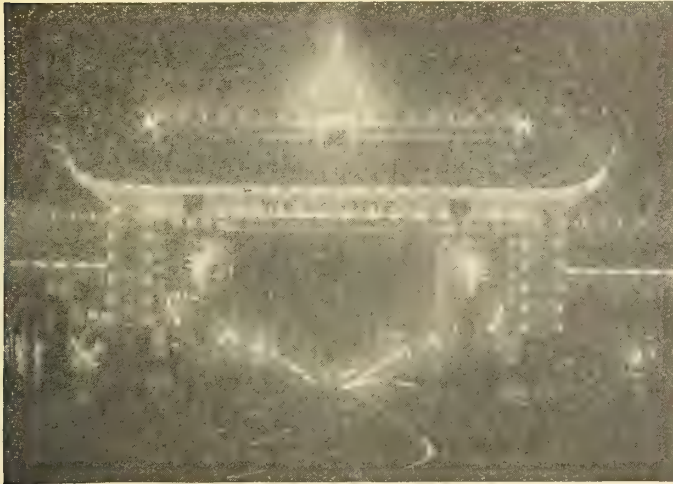
The Empress Hotel, Victoria, during Royal Visit

dent, D. R. Kennedy; vice-president, J. Jenkinson; secretary-treasurer, K. B. Ryan; executive, Messrs. Priestman, Fraer, Langdon-Davies and Johnson. The meeting of the section was the first held in its new quarters on the fifth floor of the B. C. Electric block in Vancouver. In the plans for the building the company provided a large lecture room capable of seating over two hundred, designed for the use of the section and the various educational meetings for the employees. The room is admirably adapted for its intended uses and at the annual meeting it was suggested that it would lend itself admirably for the holding of monthly dances and concerts. Arrangements of this character will probably be made by the new executive. Under the favorable conditions created by reason of the provision of new quarters, it is expected that the meetings of the section will develop greatly in attendance during the coming season.

The Ritchie Agnew Power Company, of Prince Rupert, is applying for a license to use 1,000 cubic feet of water per second out of Stamp River, and a similar amount from Ash River. The water will be used for the development of electrical energy.

Attended the U. S. Convention

The B. C. Electric Railway Company sent a large deputation of its officials to attend the annual convention of the American Electric Railway Association and other Eastern Electric Railway Conventions, the party consisting of A. Purvis, superintendent of the interurban lines; H. W. Dyson, of the comptroller's office; S. B. Thompson, mechanical superintendent; S. L. Prenter, of the transportation department; A. E. Beck, of the legal department, and G. A. Dickie,



Chinese Arch, Victoria, during Royal Visit

master mechanic, from Vancouver, with A. T. Goward, local manager, and J. R. Hughes from Victoria. Following the close of the convention, Messrs. Purvis, Dyson and Thompson are taking an extended trip covering various cities in the United States and Canada, studying general conditions pertaining to electric railways.

B.C. Telephone Notes

During the next six months the British Columbia Telephone Company will expend \$1,000,000 for telephone extensions in British Columbia. This amount will be utilized in erecting two or possibly three new exchanges in Greater Vancouver in making an addition to the Victoria Exchanges, recently completed, putting up new poles, laying cables and replacing other lines. The city of New Westminster will benefit largely as a result of the extended programme. The total expenditure in bringing that city's system to a modern standard is estimated at fully \$125,000.

A new submarine cable to connect Vancouver with Nanaimo and Vancouver Island generally, is at present in course of manufacture at Henley's, London, and will be shipped early next spring. It is to be laid between Point Grey and Newcastle Island.

Construction work will soon be commenced on a six-storey combination office and warehouse building, which the company will erect on Yukon and Front streets, Vancouver. The cost of this structure will be approximately \$100,000.

The new submarine cable to be laid across Burrard Inlet connecting Vancouver and North Vancouver is in transit, and its arrival at the coast is expected within the next few weeks.

Vancouver Island Electric Railway Co.

The Vancouver Island Electric Railway Company, Limited, recently made an application for a license to store or pen back 200,000 acre-feet of water from Sproat River, also for a license to store or pen back 100,000 acre-feet from Campbell River. In addition the company applied for a

license to use 3,300 cubic feet of water per second from Campbell River, 2,000 cubic feet per second from Stump River and 750 feet per second from Qualicum Creek, all on Vancouver Island. It is stated that the water will be used for railway and power purposes on unsurveyed land lying near Cameron Lake, north of Nanaimo. Representatives of the company recently visited the city of Nanaimo with the object of obtaining data as to future prospects should they install a line to furnish electricity both for light and power purposes. It is probable that, should the application of the company be granted, its operations will be extended to this city in the near future.

Western Canada Power

In a descriptive article on the plant of the Western Canada Power Co., appearing in our October number, we inadvertently omitted to give credit to a trio of engineers whose excellent work has done much towards placing this plant in the highest rank of Canadian hydro-electric installations.

Mr. Wm. Kennedy of Montreal engineered the original work for the Stave Lake Power Company, and laid out the scheme which formed the basis for the present development.

Mr. J. C. Kennedy as the chief engineer of the Stave Lake Power Company carried out the original work, including the principal part of the sluice dam.

Mr. W. R. Bonnycastle laid out the original electrical designs for the Stave Lake Power Company, and carried through the designs of the power house and receiving station in so satisfactory a manner that no material change was required in the course of construction.

The B. C. Electric Railway Company and the Canadian General Electric Company are making arrangements to install on trial, eight magnetite luminous arcs for ornamental lighting at Vancouver. If satisfactory, it is intended to install this class of lighting on Broadway and it is suggested that a combination pole for supporting lamp and trolley wire be used. These lights are to be similar to those installed in New Haven, Conn.

The light and power department of the B. C. Electric Railway Company, which will have jurisdiction in the Fraser Valley district, has now established an office in New Westminster.

The Electric City of Canada

The city of Hamilton has reason to be proud of a very excellent descriptive booklet just received which both pictorially and artistically reaches a very high standard of merit. In this booklet, the facilities enjoyed by this thriving city are brought home to the reader in brief and forceful language. An excellent map accompanies the booklet, copy of which may be had on application to H. M. Marsh, Commissioner of Industries, Hamilton.

Referring to Hamilton as an electrical power centre, the following paragraph is of interest:—"Hamilton possesses the advantages of having competition along this line and rates are consequently exceedingly low. Far famed as the 'Electric City of Canada' it has a practically unlimited supply of electric power from large power companies economically generating power from Decew Falls 35 miles, and Niagara Falls 42 miles distant. The Hamilton hydro-electric department is municipally owned and sells power at cost, while the Dominion Power and Transmission Company, a public service corporation, is ever ready to serve manufacturers in the best possible manner and to their entire satisfaction. Large users of electric power claim this company supplies the cheapest power in Canada."

Canada's Busy Prairie Provinces

Street Lighting System of Saskatoon

The city of Saskatoon has installed up to the present time 500 5-light, 60-watt, tungsten standards in the business section of the city. These standards are placed 100 ft. apart on both sides of the street directly opposite one another. At each corner of the sidewalk there are 2 standards each placed in line with inside of sidewalk making a total of 8 standards on all four corners at the intersection of streets. The streets are now well lighted and the effect is very pleasing to the eye. Previous to the installation of the standards the business section of the city was lighted with arc lights placed at the intersections of the streets which gave a poor distribution of the light. With the present method the streets are uniformly lighted.

The system is 110 volts with lamps connected in multiple. The different streets are controlled by two circuit time switches contained in steel boxes placed on poles in rear lanes. One circuit controls the bottom lights of each standard, which are extinguished at 12 p.m., and the other circuit controls the top light of each standard which is extinguished at daybreak.

32 of the 500 standards were installed last year on 21st street. The method of connecting these was to run a 1¼-in. iron conduit from standard to standard about 18 in. under ground with a 3-wire lead-covered cable pulled into it. Mr. Sangster, the electrical superintendent for the city, found this a rather expensive method of connecting the standards and having learned that in Europe they were using, with good results, a lead covered flexible armored cable for this purpose, which was simply buried in the ground about 18 in., he took the matter up with some of the municipalities on the other side with the result that this method was adopted here in connecting up the balance of the standards which were installed this summer.

The lead covered, paper insulated, 3 wire, flexible armored cable, 16 miles in all, was furnished by the Canadian British Insulated Co., being made in England. In laying this cable it was only necessary to dig a small trench 18 in. deep along edge of curb and bury the cable in same bringing ends up to base of standards underneath the curb

and through a small hole made in the sidewalk covered by the standard, the ends being run into pot-heads at the base of each standard. By this method the city has saved 30 per cent. of the cost of the iron conduit method. The maximum circuit voltage drop is 2 per cent. from the time switches to the most remote light.



Connecting lead-covered cable to pot-heads

The city intends installing 500 more standards of the same type next year with the same method of connecting which so far has proved highly satisfactory. In addition to the 500 standards the city has two Westinghouse magnetite sets with 50 arcs on each and two Adams Bagnall series sets with 35 lights on each. These arcs are distributed through the residential parts of the city. The city will also install 100 additional arcs next year.

The greatest trouble Saskatoon experiences in street lighting is to keep pace with the growth, this being so rapid that it is difficult to furnish light to the large number of new streets as quickly as they are being opened up



Second Avenue, Saskatoon—Five-light ornamental Standards—Eight at Corners

Figures Relating to the Cost of Installation and of New Equipment for Regina's Railway System

Figures relating to the cost of installation of electric railways in towns and cities of average size are of prime importance in considering the probabilities of operation at a profit. At the present moment, in Canada, a number of cities are either installing or thinking of installing electric railways and though there is no doubt about the immediate advantage of an electric railway in promoting the manufacturing and other interests of any town or city, the uncertainty of where the undertaking will lead the municipality in the matter of expense is holding back construction work on a number of systems.

Actual figures on construction costs in any average-sized town or city are therefore specially helpful, and the following, with reference to Regina's up-to-date system, operating since July 29, 1911, may be taken as typical of the cost of a thoroughly reliable railway line with first-class equipment and under first-class supervision throughout. These figures have been supplied through the kindness of Mr. H. Doughty, superintendent of the Regina street railway, who has been with the system from the start and to whom, consequently, its fine showing on a little over one year's operations, is almost entirely due. To the information on cost of construction is also added the cost of recently ordered rolling stock.

Regina Street Railway Cost Data

1911 Construction.—10½ miles single track. Approximate expenditure, with six single truck cars, \$500,000.

1912 Construction.—Three miles constructed. Fourteen cars added. Approximate expenditure, \$250,000.

Passenger returns to August 31st, 1912: Passengers carried, 1,760,969; revenue received, \$81,955.45.

Present weekly operation.—Passengers carried, 53,000; revenue received, \$2,300.

Number of cars in operation, 12; number by December 31, 1912, 20.

1913 Construction (Sanctioned).—18 miles single track; 12 double truck cars; 6 single truck cars; 1 additional snow sweeper; 12 gravel dump cars; 18 garbage cars; 4 construction flat cars; 1 construction motor car.

Approximate cost of 1913 construction (including pavement between tracks), \$700,000.

No orders have yet been placed for any material required in the 1913 work. It is proposed to call for tenders early in January next, so as to enable the city to get the material on the ground with a view for an early construction as soon as the frost is out of the ground.

Cost of New Equipment

During the second week of October orders were placed for the supply of eight double-truck street cars as follows:

Eight 28-ft. car bodies, p.a.y.e rear vestibule, supplied by the Preston Car & Coach Company, Preston, Ont., at a cost of \$31,272.

Four quadruple 101 B. motor equipments and eight sets straight air brake equipments (Canadian Westinghouse), at a cost of \$11,856.

Four quadruple G.E. 80 A. motor equipments (Canadian General Electric Co.), at a cost of \$9,400.

Eight sets 27 G. 1 trucks, all steel rolled wheels (Dawson & Co., Ltd.), at a cost of \$7,360.

Each car costs complete f.o.b. Regina \$7,481.

Car Specifications

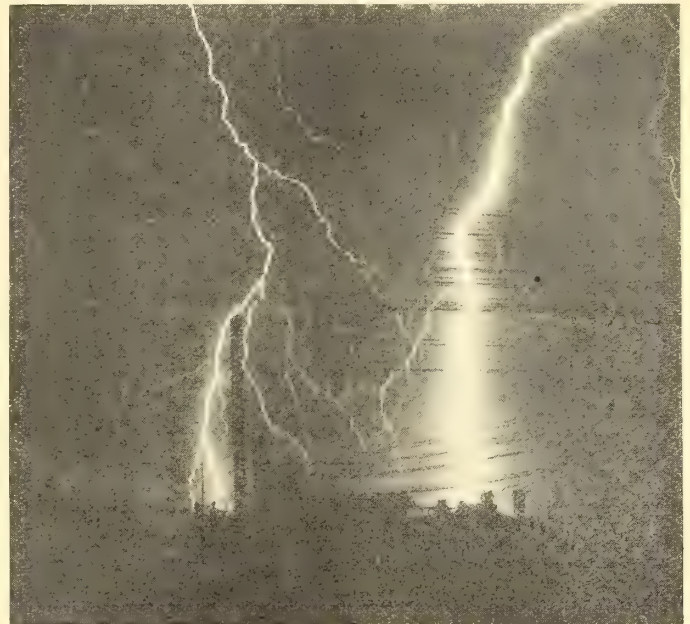
Bodies.—Length of car body, 28 ft.; length of front vestibule, 5 ft.; length of rear vestibule, 7 ft.; length of car over bunkers, 41 ft.; width of car, 8 ft. 6 in.; seating capacity, 38 persons.

Trucks.—Diameter of wheels, 33 in.; width of tread, 2½ in.; width of flange, ⅞ in.; depth of flange, ⅞ in.; diameter of axles, 4½ in.; standard gauge, 4 ft. 8½ in.

The Regina Municipal Railway to-day is paying, over and above operation charges, all fixed charges against capital expenditure and is showing a fairly satisfactory net profit. Date of commencement of operation, July 29th, 1911.

Heavy Lightning Discharges

The past summer has been an exceptionally stormy one for Winnipeg, there having been a very large number of heavy lightning storms. The accompanying illustration shows a typical discharge from one of the most severe storms of the season, which occurred September 7th. This storm came up about 9.30 p.m. and the lightning was incessant until three in the morning. In some of the discharges one



Lightning flash at widest point shows 12 in. width

of which was snapped by the camera, the lightning seemed to pour down out of the clouds like a stream of water, and to the eye, at least, there seemed to be burnt particles in the air after the discharge was over. The negative of this lightning flash was absolutely not retouched in any way. A close inspection of the negative indicates that the center of the heavy flash was turned to a positive, and shows in the print as a thin dark line. Service was maintained by both of the power systems with no interruptions, save on several distribution circuits where the lightning struck transformers and caused a short disturbance. The tall tower shown dimly in the reproduction is 18 inches in diameter and about 20 feet from the camera.

A Railway Type Street Sprinkler

The accompanying cut shows the type of street railway sprinkler now used on Winnipeg streets. As it almost always the rule that the street railways follow the most used thoroughfares, and hence the most dusty, it seems quite evident that such a sprinkler would be much more efficient than the teams usually used for such work.

This sprinkler is the only one in use at present, and was purchased by the Winnipeg Electric Railway Co., and sprinkles the streets for the city on a mileage rental basis. It has a tank capacity of 5,000 gallons and will flush 250,000 square feet at a speed of 6 miles per hour on one filling. It was built by the McGuire Cummings Co. of Chicago, and

the following description covers the general features of the equipment. The car body is 34 feet in length over all, and is of structural steel construction throughout. The tank is of the double compartment type, one being for water and the other for compressed air. A large motor driven air compressor with a capacity of 50 cu. ft. per minute continuous operation at a pressure of 80 lbs. fur-



Street Sprinkler operated by Street Railway Company

ishes the pressure for spraying and flushing. There are two sprinkling heads on each end of the car, controlled by hand wheels on the dash, operating quick opening valves, and also regulating the direction of the stream. There are two flushing attachments on each side of the car and these may be swung out so they extend 6 feet from the side of the car. The motive equipment comprises two sets of McGuire Cummings type, 10-A.M.C.B. trucks with Canadian General Electric Co. type 80-A motors, two controllers and accessories, and Westinghouse air brake equipment. While only put in service during the latter part of the summer it has so far given very good results. The equipment was supplied by the W. E. Skinner Co., Limited, who are the Canadian agents.

Saskatoon

The phenomenal development of the western city is nowhere better exemplified than in the growth of the electrical business in Saskatoon as shown by the monthly progress reports of electrical superintendent Sangster. During the month of September, the number of lamps sold totalled 1492 and heating appliances 54, the amount realized from these sales being \$2,102.65. The number of meters installed for new customers was 153 for light, and 6 for power, the latter representing 190 h.p. This brings the total number of light consumers to date to 2956 and of power consumers to 191. Under the heading of Inspection Department, the number of permits issued is 631, representing fees of \$334.25. The number of poles erected during the month was 100, cross arms 664, wire 19 miles. 23 arc lamps were installed, bringing the total of arcs up to 156. 17 new transformers were placed in service representing a total capacity of 415 kw.

The power generated in both the old and new power houses was 376,811 kw. hours, an increase of 100 per cent. over the same month last year. The amount of water pumped was 68,110,358 gallons, an increase of 79 per cent.

The income from electric light and power during the month of September was \$20,310.11, an increase of 73 per cent. over one year ago.

Rejuvenated Sons of Jove

The Rejuvenated Sons of Jove in Winnipeg have done no serious work during the summer, believing that it is the proper time for diversion. A very well attended picnic was held at Winnipeg Beach August 24th, and the many diversions provided a very enjoyable afternoon and evening for the one hundred and fifty odd Jovians and guests who attended. The premier event was the baseball game between two picked teams captained by Messrs. Schumacher and De Cew, in which the former won a decisive victory. A well contested program of athletic events followed, in which the ladies as well as the Jovians and male guests were given an opportunity to display their athletic prowess. A very good prize list added an extra incentive to good work, but the single men had considerable trouble in trying to pull down part of the grand stand in their tug of war with the married men; they were, however, finally awarded the prize on the second pull. Supper was served at the Canadian Pacific Railway Company's hotel, after which dancing and other amusements were indulged in until train time.

September 10th was Theatre night for the Jovians and a large number with their wives and friends attended a theatre party and lunched afterwards. These diversions have served a very useful purpose in bringing the various members of the electrical fraternity in Winnipeg into closer touch with one another socially, as well as providing needed relaxation.

New Books

Wireless Telegraphy and Wireless Telephony— by Chas. G. Ashley and Chas. B. Hayward; the American School of Correspondence, Chicago, publishers. This book has been produced with the idea of satisfying the public demand for a practical and understandable presentation of this subject. The development of the wireless telegraph is carried out logically from the early forms to the latest adaptations of the most important systems. The discussion also includes the application of wireless telegraphy to the aeroplane and dirigible. A considerable space is given over to wireless telephony, a science that is being rapidly developed and, on account of its advantages, likely to become more universally applicable in the near future. This book should be read with deep interest by everyone interested in wireless operations.

Practical Electricity.—A useful little book on "Practical Electricity" is published by the Cleveland Armature Works which possesses the added advantage of being a handy pocket size. Each chapter is followed by a series of practical questions to which the answers are given in the back of the book as in an ordinary text. The last 150 pages is devoted to definitions of electrical terms. The book has been written especially to assist those who have some practical knowledge of electricity and who wish to learn more of the way in which wiring is calculated and of the simpler and more important parts of dynamo electric machine design, and is arranged so that anyone who is willing to devote some effort to it, can get a clear conception of the more important laws underlying these subjects. We recommend this book for the operating electrician who has not had the advantage of a technical training.

The Shawinigan Water and Power Company are putting in a third generator set of 15,000 kw., at Shawinigan Falls. The generator is being built by the Canadian Westinghouse Company, at Hamilton, while the transformers will be supplied by the Canadian General Electric Company, and the water wheels by the I. P. Morris Company. It is expected that the unit will be running by February 1st.

Montreal and Eastern Canada

Montreal Tramways

Affairs of the Montreal Tramways Company have again been vigorously discussed during the past month, and there has been much cross-firing as to the demands of the company for new routes, with consequent expropriations and heavy outlay, and on the other hand the requirements of the city in the way of improved services. The company have made certain proposals which they contend will meet the situation, involving a considerable expenditure on the part of the city, and claiming that the company are doing all that is possible with the present lines. After some negotiation, a committee of the council met Mr. Robert, the president, Mr. Hutchison, the manager, and Mr. Perron, the legal adviser, and discussed the whole position, Mr. Robert declining to express a definite opinion as to a proposed underground system.

An exhaustive inquiry into the working conditions of service, equipment, etc., of the company is to be made by the Quebec Public Utilities Commission. The first meeting was held on Oct. 8th in Montreal, when the commissioners ordered the company to start work on lines running to and from Montreal West within four days. At the second meeting on Oct. 16th the Commissioners asked for information as to whether the company had provided, in obedience to previous orders, equipment to lessen danger to the public, and whether contracts, charters or franchises are being carried out. The company were called upon to supply a copy of every contract or franchise held or controlled by them respecting the operation of a street railway or tramway line on the Island of Montreal, to supply maps showing all routes now built or building upon the island, and a list of the cars in operation upon any of the lines. In the latter connection the company were asked to give the number of single and double truck cars, the date of such cars being put in service, the character of the brakes and other controlling devices, the capacity, length and width of each car, the ventilation and heating. Exhaustive particulars were also asked for in relation to mileage of each route, the frequency of the service, financial details as to capital issued, allotted and paid up, expenditure upon investments and maintenance, repair of rolling stock, etc. A return of complaints, protests, demands, etc., for extended facilities for two years were also requested.

The Supreme Court having decided that the company cannot convey freight without a proper by-law, the company declined to haul any freight for the city or for private contractors. This involved much inconvenience, and the question was thoroughly gone into by a committee and Mr. Robert, with the result that the committee agreed to ask the council to give a temporary permit to the company, pending the passing of a by-law allowing the transportation of freight. The council, however, referred the matter to their counsel, and on their advice agreed to give a permit until December 1st.

Growth of Wireless Telegraphy

At the luncheon of the Electrical Association of the Province of Quebec, Montreal, on October 10, Mr. A. E. Reoch, of the Marconi Wireless Telegraph Company, gave a talk on the present status of wireless telegraphy. First he described the growth of the invention, beginning with the discovery of the Hertzian waves in 1888, and pointed out that in 1895 Marconi patented his apparatus in London. Much of the original apparatus invented by Marconi had

become obsolete, and had been discarded. The vital part of the system was the oscillation transformer, patented in 1900, which was absolutely necessary in transmitting and receiving. In 1902 the receiving apparatus was patented, and this was based on discoveries by Professor Rutherford, who was then a professor at McGill University. The chief systems to-day were the Marconi, Telefunken, Poulsen, Fessenden and Goldschmidt, and Mr. Reoch briefly described the main points of these systems. The Marconi receiving appliances were essential to all systems and so also was the oscillation transformer, the latter being used for tuning.

Developments in wireless had taken the same course as other branches of science, and the apparatus had become simpler, especially in the small distance equipment, so that it was now possible for an ordinary telegraph operator to be trained to work the apparatus. In the present small sets, $1\frac{1}{2}$ kw. of power was the usual standard, which would enable messages to be sent from 150 to 350 miles. For trans-Atlantic work covering 3,000 miles, 200 kw. of power was used. Mr. Reoch detailed the purposes for which wireless stations were used, including reporting and keeping in touch with steamers, supplying steamers with a news service, and despatching news and commercial messages. Fourteen years ago only four steamers were equipped with the system, now at least one thousand steamers had Marconi apparatus, and some two or three hundred steamers had other apparatus. The system was also of great value in increasing the safety of travelling at sea. Five years ago a commercial trans-Atlantic service was commenced between Canada and Great Britain, the Canadian station being established at Glace Bay. Through recent inventions it was possible for (say) two stations to be established twenty miles apart in Nova Scotia and two the same distance apart in England and two different messages to be sent and received simultaneously with perfect accuracy.

Replying to questions, Mr. Reoch stated that messages were sent from Glace Bay direct across the Atlantic without being relayed.

Higher Standard of Illumination

"A Higher Standard of Illumination" was the subject of a lecture given by Mr. C. A. Howe, illuminating engineer and general manager of The Holophane Co., Ltd., Toronto, before the members of the Montreal Electrical Society at their meeting on Oct. 4, at the Monument Nationale. Mr. Howe referred to the comparatively recent date of the work of illuminating engineers, whose province was to study the problem of getting the maximum amount of illumination where it was wanted. Contractors, he said, could by a little study give their customers greater satisfaction by seeing that they received the best lighting results from the expenditure of money for lighting installations. It was only a matter of ten years since illuminating engineering began to be recognized and now the Illuminating Engineering Society had its thousands of members, including many Canadians. In illuminating engineering three things had to be given consideration: first, the quality of light; second, the quantity of light; and third, the treatment and placement of the illuminant. The ordinary store might be well lighted, but in many instances the owner was not getting the best results in the illumination. There was a distinction between light and illumination—light was the cause or source and illumination the result. Illuminating engineering was not guess work, it was a science.

Mr. Howe then explained the methods of measuring the light in a given place and demonstrated the enormous increase in illumination which can be obtained by the use of different globes and reflectors. He exhibited various types of glass ware, and remarked upon the good results which contractors could secure by employing suitable globes. This glassware was now being freely used for the commercial, home and industrial purposes, and it was mentioned that the globes shown were manufactured in Canada. Referring to indirect lighting, it was stated that 85 per cent. indirect and 15 per cent. direct lighting was better than total indirect lighting. There have been big developments in the manufacture of metal reflectors for industrial lighting, and some very excellent results are obtained from their use. Factory lighting is very important, and great care and study should be given every installation so that proper illumination is afforded the operators.

Several questions were asked, and Mr. Howe said, in answer to one, that general lighting was preferable to desk lights in an office; this was also true of lighting for factories, although of course each case had to be individually studied. Mr. Howe insisted upon the importance of using the proper holders, lamps, and reflectors in combination, in order to procure the maximum results.

At a business meeting held prior to the lecture, Mr. Mochon presiding, the programme for securing 1000 members by the first of January was outlined. A vigorous effort is being made to strengthen the society, and it has been decided to hold meetings the first and third Fridays every month. The first meeting in every month will be of a social character and will be held at the Auditorium, while at the other meetings, to be held at the Monument Nationale, papers will be read by gentlemen prominent in the electrical business. The chairman stated that the society desired to interest all branches of the electrical industry, and that in order to secure members all those connected with the business on the Island of Montreal would be circularized.

Sherbrooke Railway and Power Annual

For the year ending June 30 last the net profits of the Sherbrooke Railway and Power Company were \$36,542, including \$3,694 balance brought in. Bond interest absorbed \$33,077 and accidents \$1,123, leaving \$2,341 to be carried forward to profit and loss. In the report, it is stated that the scope of the company's operations were considerably enlarged during the year by the acquisition of several companies, and the directors consider that the earnings have been very satisfactory under the conditions which existed. They were naturally affected by the reconstruction of the street railway on some of the important streets during the early part of the year; by the partial earnings from power on the main system; by the purchase of power from the Stanstead system during the building of the transmission line; and because the statement shows only three months earnings from power for the Stanstead system, since the completion of the transmission line. The present year, in addition to showing the full year's revenue from the above mentioned sources, will include the revenue from the sale of additional power which, when connected up, will yield an increased revenue of about \$20,000, contracts for which were signed in July and August.

At the annual meeting the following officers were elected: Messrs. R. T. Hopper, S. H. Ewing, Frank Thompson, C. J. McCuaig, W. J. Thorold (London, England), William Farrell and D. R. McCuaig. At a subsequent meeting of the board Mr. C. J. McCuaig was elected president, Mr. S. H. Ewing vice-president and Mr. Frank Thompson secretary of the company.

Montreal Harbor Commissioners

In our last issue we stated that it is part of the improvement scheme of the Montreal Harbor Commissioners to in-Major G. W. Stephens, the president, in welcoming the members of the Montreal Electrical Society on the occasion of their inspection of the harbor, made a definite announcement on this subject. The Commissioners, he said, were looking forward, in the near future, to making Montreal, from an electrical point of view, unique among the harbors of the world. They hoped to be able to develop sufficient power to run the harbor, electrify their railway line, and light all the wharves. Probably some members of the society would assist in the work of making the port nationally and imperially greater than it is to-day. Under the guidance of Mr. Stephens and Mr. Fennell, assistant secretary of the Commissioners, the members of the society, to the number of seventy, visited the elevators No. 1 and 2. Afterwards, the members boarded special cars and were taken to the river front at Maisonneuve, where they went over the work being done by the Commissioners to accommodate the new dry dock constructed in England by Vickers, Limited. The return journey was made in the tug Sir Hugh Allan, the party being photographed on their arrival at the wharf.

The Commissioners are installing on the high level of the Victoria Pier, from the first to the third subways, a number of new pattern A-B arc lamps. These are being placed alongside the concrete pavement, and will give a particularly brilliant light. The standards are spaced 125 feet, and are of the double arm type. The base is of cast iron, with ornamental piping, and at the top there are some neat scroll fittings. The lamps are of 3,000 candle power; current is supplied by the Montreal Light, Heat & Power Company.

Electric Trucks for Canadian Express Company

For the first time in Canada, one of the transportation companies, the Canadian Express, have adopted electric trucks. The company have purchased five G. V. trucks, manufactured by the General Vehicle Company, of Long Island City, New York, for which R. E. T. Pringle, Montreal, are the agents. Three are of two-ton capacity, and two of one-ton capacity; of these two two-ton trucks and one one-ton are for Toronto, and one two-ton and one one-ton for Montreal. The vehicles have a speed of from nine to twelve miles an hour, and will make a journey of forty-five miles on a single charge. It is claimed that the electric is more economical than either horse or gasoline trucks for concentrated city service. In Montreal the Eugene F. Phillips Electric Works, Limited, have a two-ton G. V. industrial truck and the Montreal Light, Heat & Power Company a 750 pound wagon.

Quebec Electrical Association

Members of the Electrical Association of the Province of Quebec held their monthly meeting in Montreal, on October 11, with Mr. Clarence Thomson in the chair, when the by-laws revision committee submitted a report of a proposed new constitution. The object is to hold an annual meeting in February, in place of the present monthly meetings, and to vest powers of dealing with matters affecting the members in an executive committee. The weekly luncheons have, to a large extent, taken the place of these monthly meetings, and it is suggested that questions can, if need arise, be brought before the members at these luncheons, which are fairly well attended. On behalf of the by-laws committee notice was given of a motion annulling the present constitution and substituting the new by-laws. This will be discussed at the next meeting.

C. P. R. Buys Charging Plant

At the Glen Yard, Westmount, P.Q., the C. P. R. have discarded the old storage battery charging plant, used for charging the railway batteries, and have installed a complete electrical equipment for the same purpose. The plant includes a Canadian General Electric continuous current generator, 25 kw., 200 amperes, 1200-1150 speed at full load, and 125 volts. This is direct connected to a Canadian General Electric induction type, 60 cycle, 35 h.p., 34 amperes, 550 volt motor. The speed is, no-load 1200 r.p.m., full load 1150 r.p.m. The displaced equipment consisted of a Royal Electric generator, 10 kw., 110 volts, 30 amperes, with a Canadian General Electric 10 h.p., 310 volt induction motor with a speed of 850 r.p.m., connected to a 550 volt circuit.

Miscellaneous

The Montreal Light, Heat and Power Company have lately made several important contracts for the supply of power, the most notable being with Vickers, Ltd., for a block of 3000 horse power. This will be used in connection with the huge dry dock which is being placed in position at Maisonneuve.

The city of Verdun, P.Q., is making arrangements for placing wires underground. The Bell Telephone Company have agreed to this, and wires are being placed under certain streets, while it is hoped to come to an agreement with other companies. Some six or eight feet have been left alongside of the sidewalks on all minor streets.

Messrs. Fraser, Grace & Co., New York, have entered an action for \$69,532.58 against the Canadian Light & Power Company and the J. G. White Co., the latter as joint defendants. The action has reference to the contract for the Valleyfield end of the development of the Beauharnois Canal, and the claim is for a balance of the account.

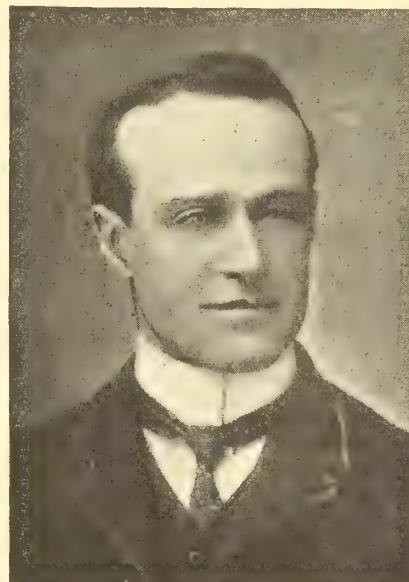
The Montreal & Southern Counties Railway Company are very busy constructing their new extensions, including the double tracking of the line between Victoria Bridge and a new station near the present one on the south side. The town of Greenfield Park has granted a 21 years' franchise to the company, and work is now proceeding. A connection will be made with the Central Vermont Railway near St. Lambert, and the new road will open up some fresh territory.

Montreal is in difficulties as to the erection of poles for the electric and telephone services. There is a by-law which was passed to prevent the erection of any further poles without the consent of the city, but it has proved of no value, as the companies have authority from Quebec to place the poles where they please. Pending the construction of the conduits the city are desirous of controlling the placing of the poles and the Controllers desire that the by-law be repealed and authority given to control the situation.

For some time negotiations have been carried on for the absorption of the Dominion Light, Heat and Power Company by the Montreal Tramways Company. The Dominion Company was formed in 1909, and there has been a considerable amount of litigation as to the promotion of the company, which has now been settled. The steam plants are situated in Maisonneuve and in the Jacobs Building, Montreal, but most of the power is supplied by the Canadian Light & Power Company, the plants being used chiefly in emergencies.

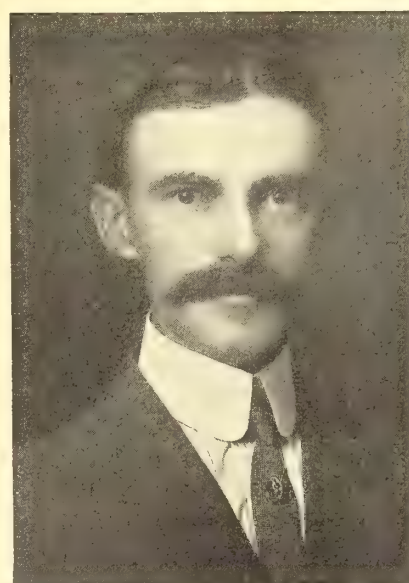
New Officers of the Canadian Street Railway Association

The important offices of president and vice-president of the Canadian Street Railway Association, are now held by Mr. P. W. Dubee and Mr. C. B. King. Mr. Dubee is secretary of the Montreal Tramways Co. and well known in



Mr. P. W. Dubee, Pres. C. S. R. A.

Canadian electric circles. Mr. King is general manager of the London Street Railway. Mr. King is a native of southern Indiana where he was born 41 years ago. He was educated in the public and high schools of New Albany, Ind., and having a decided inclination for electric railway work, secured employment, first, with the Louisville Railway Co., until 1895. For the next ten years he was with the Citizens



Mr. C. B. King, Vice-Pres. C. S. R. A.

Street Railway Co., of Detroit in various capacities mostly as assistant to the vice-president and general manager. In 1905 he was appointed to the position he now holds in London.

The Ohmer Fare Register

Fare registers to be effective, must be capable of classifying the fares paid. They must be capable of registering not only each denomination of cash in its proper class, but they also must register transfers, passes and tickets. Each medium of exchange handed to the conductor by the passengers must be registered and recorded. In some cases, it has been thought by railway companies that transfers need not be registered. This is a great mistake and opens the way for failure to register in other classes without the possibility of detection.

The Ohmer register is so constructed that an unchangeable printed record of each class of fare is produced. The record is not seen by the conductor at any time; it goes direct to the office. This amounts to a guarantee that the conductor will turn in all his collections whether they are registered or not. Any system which permits the conductor to have access to the classified registration enables him to make his turn-in in accordance with such record and any unregistered fares can be held out. With the Ohmer register, all non-registered fares go to the railway company. Having the record hidden makes possible a system of discipline which is necessary and valuable. It allows the office to determine the exact relation between fares registered in each class and fares collected. This relation makes it possible to determine the exact efficiency of the conductors in their fare collection work. The system also makes it impossible to put conductors on a just merit basis and to bring about competitive efficiency by publishing, at regular intervals, percentage showing the relative standing of each conductor as regards errors made.

Accidents are so often charged to brake equipment that the attention of railway officials and the Public Service Commissioners during the last three years has been particularly directed to the brake equipment. Of course there are many accidents which no amount of care could have prevented, and which can not rightly be charged to the equipment at all. Of the others many of them result from the failure of other equipment than the brakes. Nevertheless it is impossible to escape the fact that many accidents are either the direct or indirect results of the car's brake equipment. No one will question the value of the service rendered by the inventor of power brakes. Transportation could not be what it is to-day without them; yet strange as it may seem, their very efficiency is one of the general causes of accidents. Particularly is this true of that class of accidents where cars collide with other vehicles. These collisions are very often due to miscalculation on the part of the motorman of the distance within which his car may be controlled with the power brake. Practice and training should eliminate many of these, but the fact remains that in spite of training such accidents are constantly happening; even with experienced motormen. On the other hand, the governors, compressors and other devices which are essential parts of a power brake equipment, are subject to many disorders, any one of which will render the brake useless, and many accidents are directly due to such failures. These conditions have attracted the attention of both railway officials and commissioners, and on account of the activity of attorneys in prosecuting claims, have led the Claims Department of railways to investigate the subject.

The National Brake Company of Buffalo, N.Y., manufacturers of the Peacock and Ackley adjustable brakes, have kept pace with all this agitation, and with the new sizes and designs of brake which they have developed, are furnishing, to the railways, hand-brake equipments which will afford braking power equal to 100 per cent. of the weight of the car, with the expenditure of very little effort on the part of the motorman. The effort is so small in fact that

in cases of emergency it may be doubled or trebled, so that in the case of heavily loaded cars braking power equal to 100 per cent. of the weight of the car and its load can easily be obtained. Recent tests on heavily loaded cars with this system of hand brakes, where record has been kept of the actual weights, together with the time and distance required to make the stops, have shown this to be one of the most valuable features of this style of equipment, as there is no other method of so easily obtaining braking power proportionate to the weight of the loaded cars.

Personal

Mr. M. S. Pierce has resigned his position as vice-president of the Canadian Carbon Co.

Mr. R. A. Ross has recently been engaged in investigating the conditions of electric light and power supply in the city of Buffalo.

Mr. Beaudry Leman, who some time ago resigned his position as one of the Montreal Commission who are building conduits for placing wires underground, has been appointed manager of a branch of the Hochelaga Bank.

Mr. C. J. Walker, formerly buyer for Messrs. Lewis Bros., Montreal, has resigned his position and taken up his new duties as Montreal manager for the Canadian Tungsten Lamp Company and the Ontario Lantern & Lamp Company.

Mr. W. W. Harris, of the sales staff of the Canadian Carbon Co. Ltd., has been appointed vice-president of this company, succeeding Mr. Pierce, whose resignation took place on October 1st. Mr. Harris previously spent 10 years in the employ of the R. G. Dun & Co.

Mr. J. W. Moncur, who for the past year has filled the position of Montreal representative for the Canadian Tungsten Lamp Company and the Ontario Lantern & Lamp Company, has given up the above position to assume the duties of general sales manager for the Ontario Lantern & Lamp Company.

Mr. G. E. Wadland, recently appointed manager of the Sarnia Street Railway Co., Limited, succeeding the late Mr. H. W. Mills, has been with the same company for more than fourteen years. Mr. Wadland first started as book-keeper and accountant, and has been treasurer for the past six years. He now holds the title of manager and secretary-treasurer.

Mr. Walter J. Jones has resigned the position of engineer to the Montreal Electrical Service Commission, who are constructing conduits for placing wires underground. Mr. Jones has returned to New York. His reason for resigning was a request that he give up his office and devote all his time to the work of the Commission, which he did not feel justified in doing.

Mr. Frank Koester, consulting engineer, has removed his office from 115 Broadway to larger quarters at 50 Church street (Hudson Terminal Bldg.), New York. Mr. Koester is principally engaged in steam and hydroelectric power plant work, electric transmission and traction. He recently finished the plans for a central asphalt repairing plant of 3000 square yards daily capacity, for which he was retained as an expert by the Borough of Manhattan, New York City.

Industrial Progress and Trade Notes

"Radiant" Equipment—The Radiant Electric Company, Grimsby, Ont., have issued a pamphlet describing their electric coffee-percolators, warming pads, radiators, etc.

Automatic Switches—Catalogue issued by the Automatic Switch Company, 131 Liberty street, New York, descriptive of the various automatic switches manufactured by this company.

The "K K" Detector—A bulletin issued by the International Railophones, Limited, of Birmingham, descriptive of the construction, under-lying principles, and applications of their "K K" Detector.

Portable Cranes—Booklet issued by the Franklin Portable Crane & Hoist Company, of Franklin, Pa., describing, with illustrations and dimensions, the portable cranes and hoists manufactured by this company.

Berry's Switch Gear—Pamphlet issued by Irving Smith, Montreal, agent for Berry's patent fool-proof push and pull switch gear. These include the "Masta" patent fused-switch series, double and triple pole "Dreadnought" fused switches and the "Micalog" switch, containing no fuses.

Vickers Limited—This company is issuing from their Montreal office, 20 Bleury street, a description of the Winnipeg hydro-electric power station, re-printed from "Engineering." The description contains a detailed account of the Vickers' 3000 kw. generators which are used in this installation.

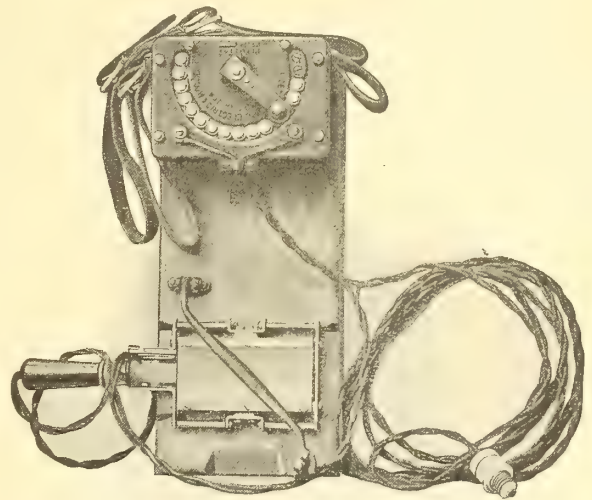
ABolites—Catalogue No. 115, issued by A. Ross Osborne, 616 Continental Life Building, Toronto, descriptive of industrial and commercial ABolites. The catalogue is divided into two sections, dealing respectively with industrial ABolites and commercial ABolites. A special feature of the catalogue is the diagonal type of steel industrial ABolites.

Car Coupler Equipment—Bulletin issued by the Ohio Brass Company, Mansfield, Ohio, descriptive of Tomlinson car coupler equipment for electric railway service, including automatic radial car couplers, automatic air-connecting car couplers, M.C.B. automatic car couplers, spring draw-bar carriers, draft gears and accessories. In this bulletin the O. B. company also announce that their coupler expert will call upon any interested railway company and go carefully into all details of service conditions and then make recommendations as to the proper type of coupler to use without obligating the railway company in any way. The booklet is beautifully illustrated showing the various types of couplers in use under many different conditions.

Federal Engineering & Supplies Limited, 284 Yonge St., Toronto, are making arrangements to move about November 1st to the new Lowes Building at 90 Sherbourne street. They find their present premises are not commodious enough, and they have taken two floors at the latter address. The Federal Engineering & Supplies Limited are carrying a large stock of Scandinavia and Lanco Balata belting; also incandescent lamps, chemical fire extinguishers and electrical specialties.

An Electric Vulcanizer

The efforts on the part of automobile manufacturers within the last few years to bring their product within the reach of a larger class of people by decreasing the prices have resulted in a larger increase in sales and a more general adoption of the automobile for every use. However, the cost of up-keep and repairing is an item that is always considered, and one that often prohibits some people from enjoying that luxury. Hence, any article or piece of apparatus that can be placed conveniently in the private garage and used for lessening the repair bill is considered advantageous to both manufacturer and the prospective buyer.



Such a device is an electric vulcanizer, recently placed on the market by the Westinghouse Electric & Manufacturing Company, which can be used on either direct or alternating current circuits. The vulcanizer is provided with a concave surface for use in vulcanizing the casing or shoe, and a flat surface which is used for the inner tubes. The concave surface is clamped to the shoe while on the wheel, and the process finished without even detaching the wheel. This is a great time and trouble saver and lessens the actual work connected with vulcanizing. The heating element consists of a metal ribbon imbedded in mica and hermetically sealed in the vulcanizer casing. This construction keeps the heater free from contact with the air, thus preventing oxidation.

The initial cost of automobile tires compels the owner to take every precaution to keep them in good condition for as long a period as possible. Unless properly attended to when first discovered, a hole in the shoe soon tears out. Often it is inconvenient to have the repairs made at that time, while with such a vulcanizer the job can be done quickly and as satisfactorily at home. The process of vulcanizing requires from 15 to 45 minutes, depending on the cut and the part to be vulcanized. In the repairing of an inner tube, the patch is placed on the tire and then clamped to the flat surface of the vulcanizer. It is essential that the vulcanizer be brought to a temperature of about 275 degrees before applying and that this temperature be maintained throughout the process. The temperature is controlled by a rheostat and read by thermometer on the clamping board. For the shoe, the heat is applied as described above, and, except in case of very severe blow-outs, little trouble is experienced in the operation. The importance of maintaining uniform heat is readily seen. The heat must

be so evenly applied that every part will adhere to the tire. The heating element is so constructed that this is cared for, while the operator is able to note the temperature by means of the thermometer and rheostat.

The complete outfit is compact, so that it can be placed anywhere in the garage. It consists of the vulcanizer, 15-step rheostat attached to a clamping board, attachment straps and thermometer and can be attached to any lighting circuit of 100 to 125 volts. In case the garage is not wired or current is not available for vulcanizing in the garage, the car may be taken to the side of the house and the vulcanizer attached to one of the chandeliers.

Tramcar Meters

Though the custom of installing meters on all electric cars has not yet become general, it has made rapid progress and the demand for car meters is growing very rapidly. This seems only natural in view of the economies effected, for experience shows that the installation of these instruments has quite justified their use from an economical standpoint.

It is impossible to say just what percentage of saving can be obtained with the use of meters, but an analysis of a schedule compiled of nineteen British systems which fur-

by running with the brakes on, running on the resistance notches, approaching stopping places too rapidly with consequent loss in braking, etc., and whereas without meters, the motorman might like to have his brakes so tight that he would only require to switch off the controller in order to stop his car, he will now complain if they are set too tightly and will watch carefully and study the equipment of each car he may be called upon to drive.

It has been shown that the saving in energy that can be effected in this way, varies from 5 per cent. to 15 per cent. according to gradients. This saving is of further interest in consideration of the fact that current is often purchased on the peak basis. Any economy which will result, therefore, in cutting down the maximum load requirements should prove doubly welcome to the electric railway companies.

We illustrate herewith a traction meter of the mercury type which has proven itself thoroughly satisfactory for this type of work. The meter is manufactured by the Ferranti Limited and distributed in Canada by Royce & Co., Toronto. This type of meter has proven superior to meters with commutator and brushes, reading approximately the same as a watt-hour meter when connected in series on a varying voltage. As a matter of fact the measuring of true watts for street railway purposes is not important, it being largely a matter of comparison between the current used under the same conditions by different motormen. In this meter a number of improvements have been introduced to meet the heavy vibration conditions. Among these is the support of the bottom jewel by a spring; the meter is heavily shunted and has a very light rotor; no top jewel; pivots are much stronger, the bottom one having a blunted round end. The meter is capable of carrying 100 per cent. over-load for 10 minutes. The guaranteed accuracy is $2 \frac{1}{10}$ per cent. from full to $\frac{1}{10}$ load. The manufacturers, where required, undertake the maintenance and inspection of these meters for a nominal sum.



nished complete information showed an average saving amounting to something over \$100 per meter per annum. This is more than might be expected of a very large railway system, but it seems reasonable to expect that the meter will pay for itself in the first year or at the most two years. Among the advantages that may be claimed for the installation of such a system is its influence on the motorman. Car meters are generally supposed to effect a saving in energy by promoting careful and skilful handling of the controller. They tend to prevent waste of energy

Automatic Telephones in England

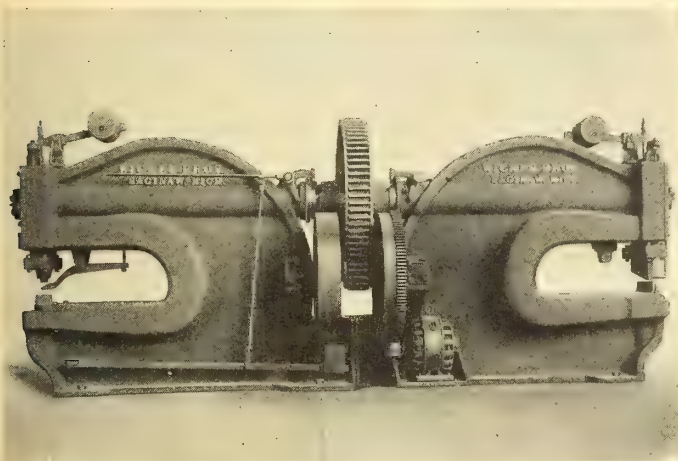
An automatic telephone equipment to replace the existing manual switchboard will be installed in Leeds by the Post Office Department, which has the telephones under its supervision and management. The installation will operate 6,800 lines in the main exchange and about 3,000 lines at present being served in branch exchanges. The new telephone building in course of erection is designed for 15,000 automatic lines. It will be completed in about six months. The time estimated to complete the full installation, including branches, is one year. The Automatic Telephone Manufacturing Co. of Liverpool is furnishing the equipment. This is the first important introduction of the automatic telephone in the United Kingdom.

Municipal Motors for Hire

The electricity sub-committee for the Leeds Corporation has requested the finance committee to apply to the Local Government Board for sanction to borrow \$48,665 for the purchase of electric motors to be let on hire. It is proposed that the motors shall range from one-half to 10 horse-power for single-phase and from 2 to 50 horse-power for two-phase motors, except by special arrangement with the manager, who is authorized to act according to his discretion. Any hirer will be permitted to purchase the motor hired by him at a price not lower than the net figure at which it stands in the books of the corporation. Each motor and each separate or detachable part of the hired apparatus will have a plate affixed showing its ownership. The city already has electric heaters for hire, as well as gas cookers, etc.

Motor-Driven, Combination Punch and Shear

The accompanying illustration shows remarkably well the space and power-saving advantage of motor drive over other forms. The motor is tucked away in a corner in the frame of this Wickes Bros. combination punch and shear, taking up no space which could be utilized for any other purpose and this machine is installed where space is valuable—in the Saginaw shops of the Pere Marquette Railroad. The motor is geared directly to the main shaft of the machine with simple reduction gears; there are no belts



Motor Driven Combination Punch and Shear

or pulleys; this means minimum transmission losses as well as the simplest construction and fewest number of parts.

The machine has a 42-inch throat opening at each end, and both the punch and the shear are operated by the one motor. The punching capacity is an inch and a quarter hole through $1\frac{1}{4}$ inches of mild steel. The shear end can cut a $2\frac{1}{2}$ inch round bar, a $2\frac{1}{4}$ inch square bar, a $1\frac{1}{4}$ inch x $6\frac{1}{2}$ inch flat mild steel or a 4 inch x 4 inch x $\frac{5}{8}$ inch angle. A bevel shearing attachment for beveling boiler plates is a part of the equipment.

The frames of the machine are of the uncored I-beam type. The cam shafts are open hearth steel forgings. The clutches are provided with both hand and foot control and have an adjustable automatic stop attachment which can be set to stop the cams at any desired position. Adjustable counterbalance weights connected through springs minimize the shocks of operation. The total weight of the machine is 45,000 lbs. The motor is a Westinghouse 10 h.p. machine-tool motor, operating on 220 volts, alternating current.

Underground Installation

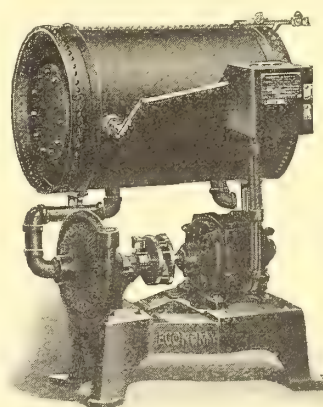
Among the many subjects discussed of late in the electric field and among the most prominent at that, is the question of underground conduit for high and low tension cables. The Hydro-electric Commission of Ontario are setting a good example by its use, not only in the large cities, but to a considerable extent in the small towns in which it is instrumental in supplying light and power. Also the Bell Telephone Co. are gradually placing their entire system under-ground even in the villages; and a few of our large cities, such as Montreal, Hamilton and others, either have outlined a comprehensive municipal under-ground conduit system or have the subject under discussion at the present moment. Such an installation actually yields revenue to the municipality, in addition to which it removes the poles and wires which destroy the beauty of the streets, gives the fire department a better chance, and in times of sleet or high wind removes the danger of the telephone

wires dropping with consequent danger from the high tension wires with which they may come in contact.

In the eastern provinces progress seems to have been even more marked in this direction than in the west. The amount of business done by the Clermont Sewer Pipe Co. of New York, which includes the Bell Telephone requirements, reaching very large proportions. The towns of Westmount and Outremont have plans in mind for very extensive under-ground work and the tunnel of the Canadian Northern Railway under Mount Royal is to be lined with clay conduits for electric cables through the whole four miles of its length. The subject of under-ground cables, proper conduits and careful installation, is one that is receiving constantly increasing attention in the engineering profession.

Handling Condensation on Low Pressure Systems

Pump manufacturers have been repeatedly asked to supply a pump with electric motor drive for returning the condensation from radiation placed below the water line of the boiler. Attention has been turned towards the centrifugal or turbine pump for this service as there is little expense attached to both the first cost and the up-keep. With these types, however, much difficulty was experienced in keeping them from becoming steam or air bound and losing their prime. As their action must of necessity be automatic this drawback made them very unreliable. The accompanying illustration shows an "Economy" automatic condensation pump and receiver as manufactured by Thomas & Smith, Inc., of Chicago, in which this difficulty is claimed to be entirely overcome. Much experimental work has been done by this firm in perfecting the equipment, and their many years' experience as heating and ventilating engineers has aided them materially in developing this pump and receiver. The return line is brought into the receiving tank at the point where the ell is shown, and as the condensation flows by gravity into the tank it raises a float which operates an automatic switch enclosed in the steel cabinet shown on the outside of the tank. This switch controls the operation of the motor and pump, starting them when the tank is filled to a predetermined level, and stopping them when the condensation has been pumped out of the tank and into the boiler. Any air or vapor collecting in the system is vented through the specially arranged check valves shown on the upper right-hand end of the tank. The float is set so that



Automatic Condensation Pump and Receiver

at no time all of the condensation is pumped out of the tank, and as both the return line and the connection to the pump are taken out of the bottom of the tank it is impossible for the pump to lose its prime. The operation of the entire unit being automatic and the receiver being small, the condensation is returned to the boiler very rapidly and at high temperature.

Five Inch Regulator

The many uses for a regulator with small motors, electric heating devices, etc., have opened a field for a regulating device still smaller than the standard C-H 6-inch regulator. The accompanying illustration shows a new 5-inch regulator placed on the market by the Cutler-Hammer Manufacturing Co. of Milwaukee. Three current adjustments are provided and an "off" point, operation being by means of the small lever extending from the back of the enclosing case. This



5-inch C-H Regulator

lever is so arranged that it sets squarely over the contacts which are mounted on the back of the porcelain base. A protecting cement completely covers the resistance material and a black japanned metal case encloses and protects the entire unit. It has a dissipating capacity of 60 watts and can be provided with a total resistance of 1200 ohms maximum.

The New York Electrical Show

The H. W. Johns-Manville Co., New York City, had an interesting exhibit this year at the New York Electrical Show, October 9th to 19th. The Audiffren-Singrun Refrigerating Machine, for which this company is the sole selling agent, attracted much interest. This is a small, efficient and particularly simple refrigerating and ice-making machine for use in residences, hospitals, clubs, etc. It is operated by $\frac{1}{2}$ to 4 h.p. motor, depending upon the cooling or ice-making capacity, and is advantageous from a central station viewpoint as a load that can be cut out entirely during the peak periods. This refrigerating machine was shown making ice and cooling a refrigerator without the intervention of ice and was also exhibited with the cold end running in the air and accumulating a sharp frost on its surface.

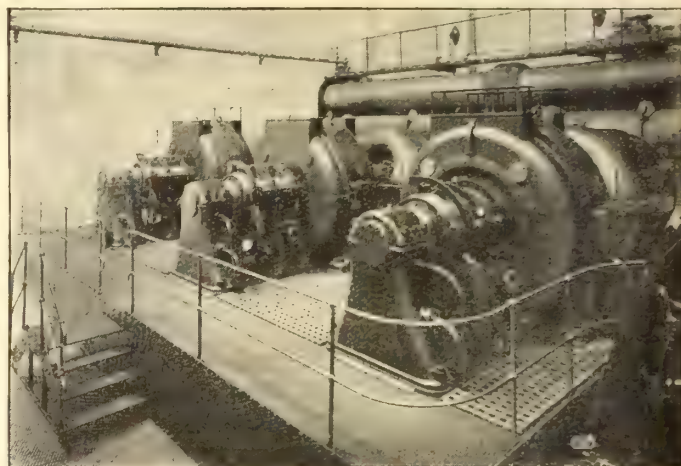
This company, well known in the lighting field by reason of their J-M Linolite system of illumination, acquired, during the early part of this year, the sole selling agency for the entire lighting products of I. P. Frink, the oldest and largest designer and manufacturer of reflectors and electroliers in the country. Some of these improved types of lighting fixtures were on exhibit. The latest developments in "Noark" service boxes for protection of power and lighting circuits were also shown. These boxes combine two devices in one—a cut-out and a switch—and operate, as their name implies, with "no arc" or flash. There were also shown J-M dry batteries, friction tape, molded insulation such as molded mica, electrobestos and vulcabeston, J-M Transite asbestos shingles and other building materials.

A New Canadian Glass Concern

The Jefferson Glass Company, Limited, of Toronto, is a new company incorporated during the past month. They will manufacture a somewhat similar line to that of the United States company of the same name, at Follansbee, W. Va., whose high grade products are so well known from coast to coast. This will be the "Moonstone" and "Luceo" glass; crystal and flint gas and electric globes; cut gas and electric globes for illuminating purposes; also a high grade make of table ware, as well as many other different lines of glass ware. The company will also specialize on glass from private moulds. The plant of the Independent Glass Company, Gerrard street and Carlton ave., has been taken over and additions and alterations made which will more than double the capacity. The company will build all their own moulds. Mr. H. A. Schnelbach, the general superintendent, has had a wide and lengthy experience in glass manufacture, having formerly been connected with the MacBeth Evans Glass Company, and latterly with the Follansbee plant, which he installed. Mr. L. O. Griffiths, the sales manager, is also a person of long experience in his line.

"Vickers" Turbo-Generator Equipments

The cut shown is a view of three "Vickers" 1,000 kw., 440 volt, direct current turbo-generator sets, running at 1200 r.p.m. and installed at their Barrow Works, England. The



Three Vickers 1000 kw. Turbo-generator Sets

complete plant was manufactured at their Sheffield Works. Each generator is shunt wound with compensating windings and interpoles, giving full load continuously, or up to 1100 kw. on overload for a period of two and a half hours.

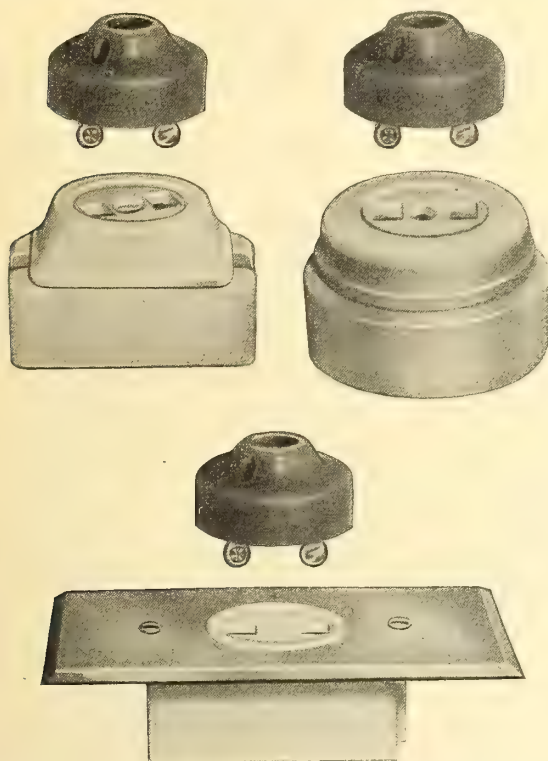
Tungsten Lamp Suit

The Canadian General Electric Company, Limited, have issued a writ seeking an injunction restraining the Canadian Tungsten Lamp Company, Limited, from manufacturing or offering for sale "drawn wire" Tungsten lamps. It is understood that, as owners of the Kuzel patents under which the Colloidal Tungsten filament lamp is manufactured, as well as other patents on Tungsten lamps, the Canadian General Electric Company offer to license the manufacture of the lamps.

Beginning with October 1st, Mr. M. S. Pierce severed his connection with the Canadian Carbon Co. of which he has been vice-president. Mr. Pierce is succeeded by Mr. W. W. Harris, formerly of the sales staff of this company. Mr. Harris was also for several years with the firm of R. G. Dun & Co.

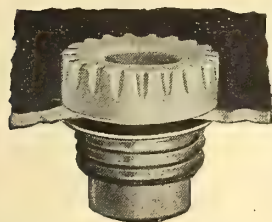
New Attachment Plug Receptacles

The attachment plug receptacles illustrated below have recently been developed by the Cutler-Hammer Manufacturing Company, of Milwaukee, to fit in with their line of attachment plugs. The caps of these plugs can be used with any of the three types of receptacles shown. The round base receptacle is for use with concealed wiring, while the rectangular base type is particularly suited for use with



moulding work. Porcelain or black composition caps are provided, although where the C-H plug is already in use the same cap can be used for plug and receptacle. The increasing use of household heating devices and small motor-driven devices has created a demand for receptacles of the types shown for wall mounting because it is not always convenient or desirable to plug in the fixture socket.

Improved Clamp Bushing



The Thordarson Electric Mfg. Company of 501 S. Jefferson street, Chicago, are putting out an improved clamp bushing, which for simplicity, time, labor and money saving points, is claimed to be superior to any on the market. It is made of one piece of the best grade of vitrified porcelain, equipped with two threaded metal sleeves. One of the sleeves is permanently anchored to the body of the porcelain, while the other holds the bushing while in use. This arrangement insures a precision of action and a saving of time far in advance of other bushings, in most of which difficulty is experienced on account of bushings and sleeves not being interchangeable. An added advantage of the Thordarson improved clamp bushing, is that the loose sleeve is reversible and when applied in that fashion holds the bushing securely in place in walls up to $\frac{1}{2}$ inch in thickness. For motor or transformer work, or where bushings must be screwed into a solid casting

or wall, this bushing is particularly adaptable. The bushing is approved by the National Board of Underwriters.

The Penrose Elevator

The British made electric elevator is growing popular in this country if one may judge from the contracts which have recently been awarded to Messrs. A. W. Penrose & Co. Ltd., through their agents, Messrs. Stuart, Drinkwater & Hingston, Limited. The Penrose elevator is being installed in the new ten-storey building at the corner of McGill and Notre Dame streets, Montreal, being erected by the McGill Property Syndicate, the contract calling for three powerful electric high speed elevators, each having various speeds under the control of the operator, thus effecting an economical service, together with a special flash light signal system. A Penrose elevator is being installed in the large Bishop Street Apartment being erected by O. L. Henault, the contract calling for passenger and freight elevators, together with a service of six dumb waiters. The latter are automatic in action, and are a specialty of the Penrose firm. A Penrose automatic push button elevator, which can be operated without an attendant, is also being installed in the new Prudential Trust Building on St. John street.

Northern Electric Notes

P. F. Sise, managing director, was in Toronto recently. M. K. Pike, distributing manager, is in Vancouver. B. C. Nowlan, switchboard sales division, is in Halifax. E. J. Lloyd of the Toronto house was in Montreal recently.

J. F. Little has been appointed district sales manager of the Vancouver house.

W. J. Doherty, supply sales manager, visited the recent electrical show at Boston.

E. H. McLea, chief engineer, has been in New York and Chicago on the company's business.

F. M. Davis has been appointed district manager of the Toronto house, and M. R. Roeder has been appointed to Vancouver in the same capacity.

M. S. Allen, telephone sales manager, and A. D. Smith of the railway sales department, were in attendance at the recent convention of the Railway Signalmen's Association at Quebec.

The Siemens Company of Canada Limited

Notice has been sent out that a company has been incorporated under the Dominion Company's Act with the title Siemens Company of Canada Limited, who will act as sole representatives of the Associated Siemens Companies in Canada. The head office of the new company will be in the Transportation Building, Montreal, and the present existing offices in Toronto and Winnipeg will be taken over in due course as branch offices. Mr. Arthur S. Herbert, the present Canadian manager has been appointed general manager of the new company with Mr. J. W. Brooks, manager of the Toronto office and Mr. C. W. Stokes, as heretofore, manager in Winnipeg. It is requested that in future, all correspondence except for Ontario and Western Canada be addressed to the head office in Montreal.

Wireless Station for Falkland Islands

The hitherto isolated state of Falkland Islands will shortly be terminated by the erection of a wireless telegraph station, the tender of the Marconi Wireless Telegraph Co. having been accepted for a 5-kilowatt installation capable of communicating at night with Buenos Ayres or Montevideo.

Current News and Notes

Berlin, Ont.

The general plan for lighting the city streets which is being prepared by the Lighting Commission will call for approximately 2,000 lamps.

Brantford, Ont.

A by-law is being submitted on Oct. 25th, authorizing the expenditure of \$115,000 to install Niagara power.

Brooke, Ont.

Important extensions will be made shortly to the Brooke Municipal Telephone Co. New equipment will be required.

Byron, Ont.

The Byron Rural Telephone Co. will extend their system several miles and install a number of new phones.

Calgary, Alta.

The council have recommended the purchase of 12 Westinghouse 101 B motors at \$550 each for street cars.

Contract has been awarded to the Can. Westinghouse Co., Hamilton, Ont., for supplying 1-75 light capacity constant current regulator; also 1 control panel, 75 arc lamps and 75 cut-outs.

Chesterville, Ont.

A by-law was submitted on October 25th, asking authorization to close a contract for light and power with the Ontario Hydro-electric Power Commission.

Cobalt, Ont.

The Northern Ontario Light & Power Company is now reported to have absorbed the British Canadian Power Co., which generates some 10,000 horse power on the Matabitchouan River. This completes the merging of the important companies in the Cobalt and Haileybury district.

Duncan, B.C.

Tenders will be received to December 1st, for the purchase of \$65,000 twenty-five-year five per cent. electric light and power debentures.

C. H. E. Williams, general contractor, 615 Pender street west, Vancouver, will receive tenders for 12 tons of weather-proof copper wire and a quantity of line material for lighting system to be installed in this town. Dutcher & Maxwell are engineers.

Edmonton, Alta.

The Alberta Monorail Co. is planning to construct a monorail line for the handling of the products of the coal mines and gravel pits of the country around Edmonton. The company are now building a four-mile line from Calgary to the gravel pit at Maharg.

Elmvale, Ont.

A by-law authorizing expenditure of \$7,000 for hydro-electric power will be submitted.

Fredericton, N.B.

An Order in Council was recently passed, conveying to the Grand Falls Co., Ltd., the water power and five acres of land at the point where this company proposes to install a large hydraulic plant and erect pulp and paper mills.

The Eel River Heat, Light & Power Co. has made an offer to the city council

to supply electric power for running the municipal water pumping and street lighting plants. The offer is to give power to the city at the town limits for two cents per kw.h., providing 200 continuous h.p. is used.

Galt, Ont.

The Lake Erie & Northern Railway Company has submitted to council a plan of its proposed route of entry into Galt.

It is stated that the Grand Valley Railway Company will establish a freight service between Brantford and Galt, and that plans are under way for the use of Hydro-electric power.

Georgetown, Ont.

The municipal authorities are taking active steps to secure a supply of Niagara power.

Glencoe, Ont.

It is said the council will at once take up the matter of having extensive repairs made to the electric lighting plant. Considerable new equipment will be required to put it in good running order.

Hamilton, Ont.

The Works Committee will ask the railway company for a number of extensions.

It is reported that the Dominion Power and Transmission Co. will build a railway line connecting St. Catharines and Hamilton, and operate it with fast electric service.

The city of Hamilton has made application to the Dominion Railway Board for an order directing the private companies operating in that city to remove their poles from the streets and place wires underground.

Hanley, Sask.

A by-law was passed recently authorizing council to raise money for the erection and equipment of a power plant.

Harriston, Ont.

It is reported that complete new equipment to the amount of \$11,000 will be required.

Ingersoll, Ont.

The Commissioners will report on the question of installing a number of additional street lights.

Lethbridge, Alta.

A large electric sign will be erected near the railway station. This sign will bear the name of the city and will set forth the outstanding advantages of Lethbridge as a manufacturing centre.

Lindsay, Ont.

The Electric Power Co., operating in Central Ontario, are giving public exhibits showing the possibilities of electric power in the operation of household and farming apparatus.

London, Ont.

The Victoria Hospital Trust contemplate extension of telephone system to all parts of the building.

The Water Commissioners will shortly require three more transformers and will ask figures on 13 more for extensions planned for next year.

Fire Chief Aitkin will recommend installation of an electric street alarm sys-

tem to be placed on all main corners to warn people of approach of fire apparatus.

The employees of the London Street Railway Company recently held their annual picnic at Springbank Park, where an excellent programme of sports was followed by luncheon and an enjoyable evening dance.

The Water Commissioners have decided to place new electric lights on every pole on Dundas street between Wellington street and the Fair Grounds. Work will start as soon as equipment is purchased.

The London Street Railway Company has made application to the Dominion Railway Board for permission to cross the Canadian Pacific Railway tracks at Adelaide street, and asks the apportioning of the cost between the city and the company.

Medicine Hat.

The question is being discussed whether the city will grant a 25-year franchise for the construction and operation of a street railway system. Sir Max. Aitken is the interested financier.

Milton, Ont.

A hydro-electric by-law passed by a vote of 189 to 4.

Mirror Lake, B.C.

The question of installing an electric light plant in this district is being considered.

Nelson, B.C.

Work has commenced on the installation of conduit to contain the cables serving a new three-globe ornamental tungsten lighting system to be installed on the main streets.

Ottawa, Ont.

It is said that an improved lighting system will be installed by the Dominion Government at certain points on the lower St. Lawrence.

Parkville, Ont.

The Municipalities of Parkville and Lucan will take up with the Hydro-electric Commission the matter of building a pole line from St. Mary's through Granton and Lucan to Parkville.

Port Alberni, B.C.

Warden & Wilkins, Williams Bldg., Vancouver, engineers, have been instructed to prepare plans for electric plant, also to estimate cost of plant and distribution system.

Rapid City, Man.

A by-law was submitted on October 23rd authorizing expenditure of \$12,000 in the installation of an electric light and power plant. In all probability a Diesel oil system will be installed.



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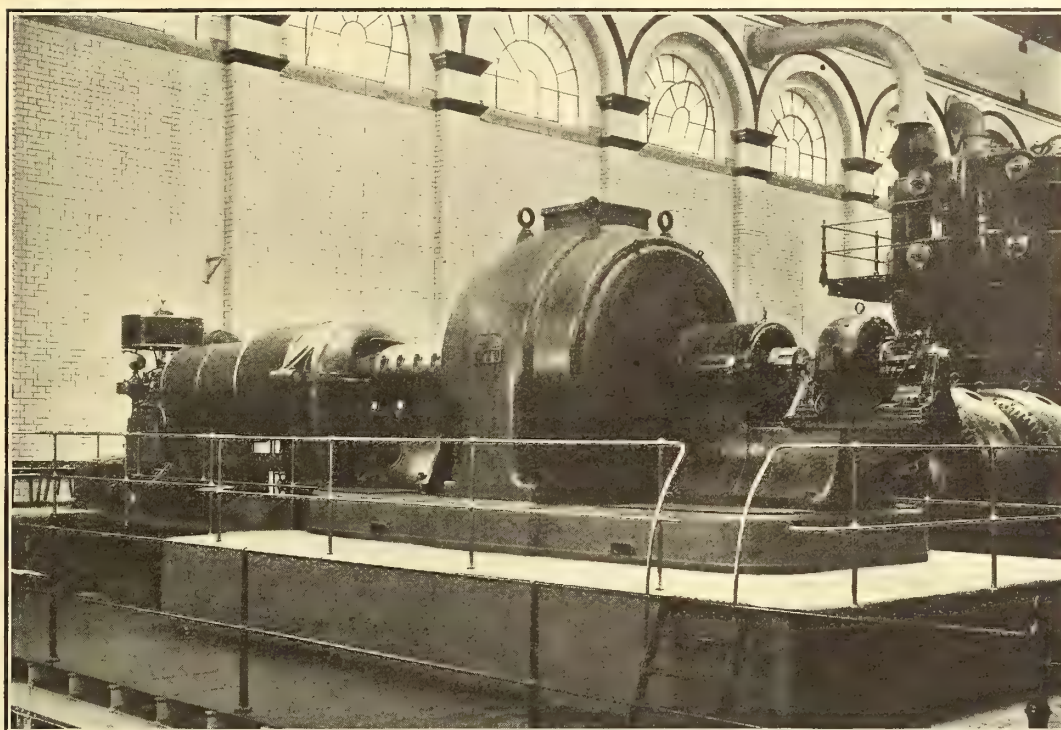
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1—1500 K. W. for City of Lethbridge.
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McARTHUR BUILDING
WINNIPEG

Regina, Sask.

It is probable the new lighting system of Regina will consist of standard ornamental pillars carrying arc lights.

Tenders will be called by the Provincial Government, Dept. of Public Works, for the construction of a two-storey, fireproof, steam-heated, pressed brick and stone telephone exchange building.

Superintendent Peters has expressed the opinion that when their new steam turbo-generator plant is installed, the city of Regina will have the most modern plant in the prairie provinces. In view of the fact that all their machinery will be new and of the latest type, this will doubtless be correct.

Rosetown, Sask.

A by-law will be submitted on October 31st to provide for an electric light system.

St. Boniface, Man.

Contract was recently awarded the Northern Electric & Mfg. Co., for twenty fire alarm signals and two stations, Gamewell manual system.

Tenders will be received by the city up to November 8th for the supply and erection of a variable speed motor and a motor-driven pump capable of delivering either 1,000,000 or 1,500,000 imperial gallons per 24 hours.

St. Catharines, Ont.

A petition has been presented to council asking that an estimate be prepared of the cost of hydro-electric lights and power in St. Catharines.

St. John, N.B.

St. John Railway Company have awarded contracts for 3-500 h.p. boilers

to Babcock & Wilcox, Glasgow, and for large chimney, 150 ft. high, 7 ft. 6 in. inside diameter at top, to H. R. Heincke Co., Inc., New York. Contract for engine and generator not yet awarded.

St. Mary's, Ont.

The council will purchase additional electrical equipment for installing lights in a large number of houses. The purchase of a number of meters has been authorized.

St. Thomas, Ont.

The Canada Iron Corporation will require 3 transformers, 3-phase, 25 cycle, 13200/550 volts; also a number of small motors.

Petitions are being forwarded to the Dominion Government asking permission for the operation of the cars of the London and Lake Erie Railway on Sundays.

Summerland, B.C.

Engineer Latimer has reported that extensions will cost \$100,000 for water-works and \$50,000 for electric lighting system.

Toronto, Ont.

A permit has been granted the Northern Electric & Mfg. Co. for the erection of a four-storey brick warehouse at 112 Bay street.

It is said that the Toronto & York Radial Railway or the Toronto Eastern Railway may be extended to serve Markham, Stouffville, Agincourt, and the surrounding district.

The Toronto Electric Light Company and the Toronto Railway Company have each placed an order for a storage battery equipment which will take care of

their complete load for approximately one hour.

Vancouver, B.C.

It is reported that at a recent meeting of the British Columbia Electric Railway Co. the shareholders voted to appoint a Canadian directorate.

Winchester, Ont.

A by-law was passed authorizing a contract closed with the Hydro-electric Power Commission.

Windsor, Ont.

Alderman McTavish will call for tenders shortly for lights and wiring for Sandwich street.

The Edison Illuminating Co., of Detroit, are reported to be planning to install a large lighting plant in Sandwich.

Winnipeg, Man.

It is reported two more units will be added to the municipal plant at Point du Bois.

The Board of Control are considering the extension of their ornamental street lighting north on Main street from C. P. R. tracks to city limits.

The first monthly report of the earnings of the Manitoba Government telephone under the new management shows an increase in the net revenue sufficient to offset the losses that the system has been showing for some time.

The application of the Great Falls Power Company for rights to install an automatic telephone system in Winnipeg was refused, chiefly on the grounds that it would not be in the interests of the city to have a dual system of telephones.

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Denver, 231—15th St.
San Francisco, 682 Mission St.
New Haven, 29 College St.
Cleveland, 1522 Prospect Ave.

Paris, 12 Rue St. Georges.
Berlin, Genest St. 5 Schoenberg.
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Telephone Train Despatching

From the wonderful development which has taken place in the last few years in the designing of electrical appliances and the application of such equipment to every day use, it is not at all strange that the field of the telephone has been extended to include the directing of train movements on steam and electric roads.

In railroading the biggest factor is time, and any

intelligence was transmitted by means of telegraphic Morse.

Fig. 1 shows you the standard Northern Electric Despatching equipment. In front of the despatcher is located a calling key cabinet. In it are a number of keys, one allotted to each way station on his wire. He calls an operator in on the line by merely giving the key allotted to that station a quarter turn to the right. The time saved in calling is a big advantage. Any way station can be signalled within a period of four seconds. A bell rung in that station and kept ringing at the will of the despatcher. A feature is also obtained here, whereby the despatcher can tell



Fig. 1

apparatus which will be a time saver is unquestionably desirable on any railroad. The telephone accomplishes this perfectly.

The Northern Electric & Manufacturing Company have supplied equipment to the largest railroads in Canada. Until now there is about 7,500 miles of track



Fig. 2

equipped. Is this not a conclusive proof that Telephone Train Despatching will take care of any conditions that may arise?

Possibly one of the distinct advantages of the telephone is the personal equation brought about between despatcher and the operators scattered along the line. The human voice is now on the wire where formerly

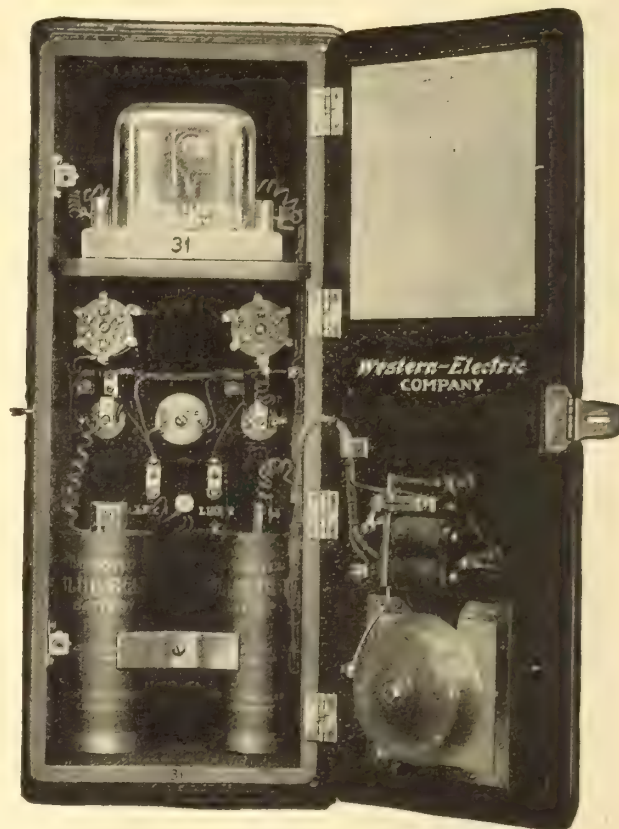


Fig. 3

whether or not the bell in the station called has rung. This is called an answer back and takes the form of a distinctive buzz that is heard in the despatcher's head receiver.

Fig. 2 shows you Northern Electric equipment as used by the operator at the way station. There are a great many types developed to meet the special conditions which change and vary on each road. In absence of the operator, anyone can answer the telephone, therefore, it is not necessary to have skilled knowledge of the Morse alphabet. An operator having outside duties to perform, such as delivery of freight, baggage or express, or looking after a pump, etc., has his attention immediately called to the fact

that he is wanted, by the ringing of his bell, while by telegraph he is called continuously until he happens to come in the office.

The development of apparatus called the "Selector" has perhaps had more to do with the rapid advance of Telephone Train Despatching.

Fig. 3 illustrates the Northern Electric Selector Set. This is an electro mechanical device whereby the despatcher can ring a bell in a way station, while



Fig. 4

all other bells on the same circuit are silent. You will see by this that it is highly desirable because the signal is only being received by the station with whom the despatcher wishes to talk. The Selector is operated by direct current impulses. These impulses are sent out over the line by means of the despatcher's sending key and a main line battery located at the despatcher's office.

Each Selector is set to a certain combination of impulses and when these impulses are received by the selector it closes a local contact which in turn rings the bell in the selector set.

Northern Electric Portable Train Telephone sets have proved themselves in actual service. Figures 4

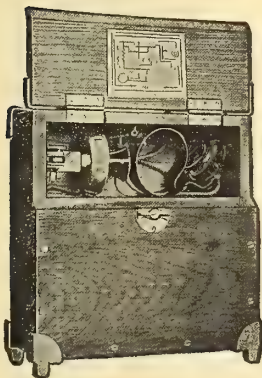


Fig. 5

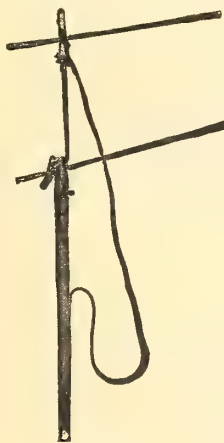


Fig. 6

and 5 show you the types most generally used. The C. P. R., who have gone into Telephone Train Despatching most extensively in Canada, have approximately 1,000 of these now in use.

The advantage accruing from the use of Portable Telephone Sets are obvious from the following in-

stances which show you the experience of one railroad. Bridge and rail laying gangs, as well as section supervisors are furnished with complete equipment enabling them to work on closer margins of time with satisfactory results as to efficiency and economy. A rail laying gang on eastbound track was about to suspend work on account of schedule time of an eastbound passenger train. By the use of a Portable Telephone they obtained word that time had been allowed



Fig. 7

on this particular train of fifty minutes, enabling them to proceed with their work accordingly. Under ordinary circumstances they would have been obliged to stop and wait until the delayed train had passed by as they were not near a telegraph office.

Wrecking trains immediately connect with the despatcher on arriving at the scene of trouble and maintain their connection until their work is done. By this means the Despatcher gets the information

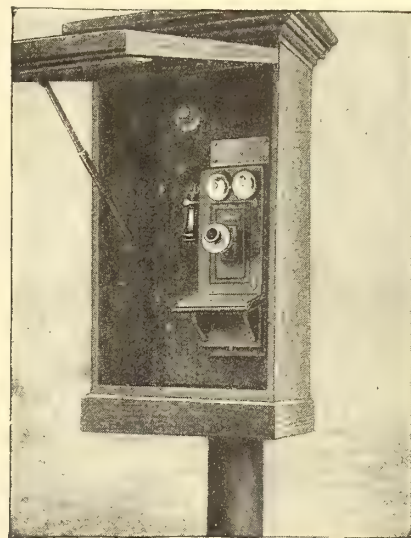


Fig. 8

required right on the spot without having to receive it through a second party, who very often does not give the correct interpretation of conditions.

Employees equipped with portable sets noticed a freight train moving eastward with a brake beam hanging down. The despatcher was immediately notified

and the train was flagged at the next station and the car set out.

A broken rail on the main eastbound track was noticed by a train crew and the dispatcher immediate-

ly notified. He directed the train crew to find section forces and inside of ten minutes of the time the rail was noticed, section men were on their way to make repairs.

Portable Telephone Sets have proved their value in operating Canadian Railways in winter. For instance, when an engine dies on the road or becomes stalled

the situation from the inside of his van and thereby getting the necessary protection and assistance. The Portable Train Telephone Set is attached to the train wire through the medium of a line pole and



Fig. 9



Fig. 10

ly notified. He directed the train crew to find section forces and inside of ten minutes of the time the rail was noticed, section men were on their way to make repairs.

flexible cord. Figure 6 shows the Richardson line pole manufactured by the Northern Electric.

An accident prevented, a life saved by promptly obtaining a physician, a few delays to heavy traffic avoided, will soon pay for the cost of complete installation of a Telephone Train Despatching Circuit.

The use of Siding Sets, placed at points wherever



Fig. 11



Fig. 12



Fig. 13

in a drift, many a train man has been saved miles of a walk to the nearest telegraph office through zero weather to get the necessary aid by merely attaching his telephone to the train wires, telling the dispatcher

the operating officials desire, such as sidings, draw bridges, crossings, etc., is a great value in that they enable the train crews to reach the dispatcher and keep him advised of their movements. Figure 7 re-

presents the Northern Electric metal type siding set. This set is mounted directly on the pole and is rust and moisture proof. Figure 8 shows another type of siding set, which is generally mounted in a pole shelter.

There are a great many types of telephone apparatus designed and used to meet the different demands of the various roads and the Northern Electric have developed special circuits whereby, if used in connection with their telephone apparatus, all way stations, although listening in on this line, simultaneously receive perfect transmission, or in other words, the farthest operator hears the dispatcher just as plainly as the operator nearest him.

First: We take the Northern Electric standard desk stand, Fig. 9, equip it with a special switch hook to accommodate the head receiver and place a special transmitter upon it, and when finished we have a very convenient way station set.

What is known as the Northern No. 1020-A. Arm, Fig. 10, is another type. This arm is being used by a number of roads in Canada. It consists of a desk stand stem mounted on tubing and is generally installed so that it swings over the desk clearing all papers or other obstacles upon it.

Another familiar telephone arm met with on Canadian roads is the flexiphone arm, Fig. 11, which consists of a movable arm that can be used in a vertical or horizontal plane.

Each piece of Northern Electric Apparatus has been designed and arranged so that they permit the operator to use both hands with perfect ease when writing his orders or messages.

The despatcher's telephone equipment is practically the same on all railroads and consists of special Northern Electric chest transmitter, supported by a band passing round the despatcher's neck and a head receiver, Fig. 12.

This apparatus is connected to the circuit by means of a flexible telephone cord, terminating in a plug which when inserted in a jack installed on the desk, completes the line connection. This arrangement is provided the despatcher so he may be able to move around at will and manipulate his train sheet.

As the despatcher is listening in on the line continuously, apparatus light and easy to wear is provided for him.

A need has long been felt for apparatus whereby a despatcher might control the movements of a train without the aid of the human factor. The selectively operated semaphore meets this need exactly (Fig. 13). It can be placed at small stations, or sidings, where it is not desired to employ an operator continuously and the despatcher can throw the semaphore to stop position, just the same as he rings the bell in a way station. The Northern Electric semaphore is of standard make and all apparatus is self contained, as many semaphores can be located on the same circuit as desired. It is furnished in either the upper or lower quadrant types and a three spectacle casting is provided.

Thus, in many ways the telephone has improved train despatching; in small ways, perhaps, considering each phase by itself; in the aggregate, in a large broad modern way. It is introducing economies, simplifying the work and making for a better service in every way.

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Sales Engineer: Large Electric Manufacturing Company wishes to employ two young men in the Machinery Sales Department, college training and shop experience required, selling experience not necessary, but such experience will be given extra consideration. Apply Box 570, Electrical News, Toronto, Ont. 10-11

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The proprietors of Letters Patent No. 127080 relating to "Process of Manufacturing Iron Electrodes for Use in Alkaline Accumulators," and No. 127081 relating to "Active Masses for Positive Electrodes of Electric Elements, etc.," desire to dispose of the Patents or to grant Licenses to interested parties at reasonable terms with a view to the adequate working of the Patents in Canada.

Inquiries to be addressed to the actual proprietors, Svenska Akkumulator Aktiebolaget Ljungner, Stockholm, Sweden.

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14—Thompson enclosed Arc Lamps ... 10.00
36—Thompson enclosed Arc Lamps ... 10.00
4—Westinghouse Enclosed Arc Lamps. 10.00

15—Westinghouse Inner Globes15
27—Can. Gen. No. 3 Inner Globes15
15—Can. Gen. No. 4 Inner Globes15
650—Solid ½x9½ Carbons, per M. ... 18.00
450—Soft ½x9½ Carbons, per M. ... 18.00
50—Solid ½x12 Carbons, per M. ... 25.00
50 Soft ½x12 Carbons, per M. ... 25.00

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Two Tandem Compound Wheelock Engines, cylinders 21 in. and 38 in. x 46 in. stroke.
Two Fly-wheels, 18 feet diameter, 46 in. face.
Two double leather belts, each 112 feet long, 42 in. wide.
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Two Northey jet condensers, cylinders 12 in. and 18 in. x 18 in. stroke.
One 6 in. line shaft 15 ft. long with friction coupling and pulley 4 ft. 11 in. x 46 in.
Six Fire tube boilers, each 63 in. diameter, 14 ft. long, containing 84 3-in. tubes. Pressure allowed by Boiler Insurance Company 110 lbs. per square inch.
Two Northey feed pumps, cylinder 5 in. and 8 in. x 12 in. stroke.
All the above water and steam connections in very good order.

Price, \$3,000

The above plant will be sold at this extraordinary price, one seventh of its cost, to anyone who will remove it at his own cost. Plant discarded for larger plant, is only reason for selling. A rare bargain for anyone who can use this plant.

THE OTTAWA ELECTRIC COMPANY,
35 Sparks Street,

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Ottawa, Ont.

Machinery For Sale at Friday Prices

1—5 kw., 110 Volt Compound C. G. E. Type B Generator.
1—7½ kw., 110 Volt Compound Westinghouse Type S. Generator.
1—110 kw., 550 Volt D.C. C. G. E. Compound Belt Driven Generator.
15—500 Volt D.C. Motors, 1 to 15 h.p.
4—½ H.P. Century and Wagner S. P. 125 Cycle Motors.
1—200 kw. 125 Cycle, 2 Phase, S. K. C. Generator, 2,300 Volt, just like new, with or without Tandem Wheelock Engine and Condenser.

The above apparatus is guaranteed just as good as new. Price about one-half their original value.

Apply,

MACKENZIE ELECTRIC CO.,
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Arc Lamps For Sale

150-Direct Current, 110 Volts;
60-Alternating Current,
110 Volts, 60 Cycle.

On account of changes in our power and lighting system, we offer our entire equipment of arc lights as above.

All are in good order and may be examined at our Toronto Factory.

Massey-Harris Co., Ltd.

TORONTO

11

Moonlight Schedule for November, 1912

Courtesy of the National Carbon Company, Cleveland, Ohio.

Date.	Light.	Date.	Extinguish.	No. of Hours
Nov. 1	5 30	Nov. 2	0 20	6 50
2	5 30	3	1 30	8 00
3	5 20	4	2 50	9 30
4	5 20	5	4 00	10 40
5	5 20	6	5 10	11 50
6	5 20	7	5 50	12 30
7	5 20	8	5 50	12 30
8	5 20	9	5 50	12 30
9	5 20	10	6 00	12 40
10	5 20	11	6 00	12 40
11	5 20	12	6 00	12 40
12	5 20	13	6 00	12 40
13	5 10	14	6 00	12 50
14	5 10	15	6 00	12 50
15	5 10	16	6 00	12 50
16	5 10	17	6 00	12 50
17	10 50	18	6 10	7 20
18	11 50	19	6 10	6 20
20	1 00	20	6 10	5 10
21	2 00	21	6 10	4 10
22	3 00	22	6 10	3 10
23	4 10	23	6 10	2 00
24	No Light	24	No Light	
25	No Light	25	No Light	
26	5 10	26	7 40	2 30
27	5 00	27	8 50	3 50
28	5 00	28	10 50	5 10
29	5 00	29	11 20	6 20
30	5 00	30	0 40	7 40
		Dec. 1		

Total.....2 40

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have demonstrated that they furnish the best existing method of connecting track and pavement in point of present and ultimate economy. If this were not the case, traction companies located at long distances from our factory would not have favored us with orders. Could they have purchased other material as good, nearer their lines, thereby effecting a saving in freight, they would have done so. Had other material been as good, over seventy per cent. of our business would not have been repeat orders.

By reason of the quality of Nelsonville clay, the method of making the brick and the **patented** construction, electric railways have been unable to procure any other form of filler and stretcher material that compares in ultimate economy with the Nelsonville product.

The reason for the widespread use of the Nelsonville product is explained in our new booklet "Rail Brick of the Right Sort."

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The Nelsonville Brick Company
Nelsonville, Ohio



110 v. 16 c.p. Carbon Lamp-
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Announcing Northern Lights

Incandescent Lamps of Quality

We are placing on the market a complete line of incandescent lamps under the trade name of

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These lamps are manufactured under our own specifications and are subjected to the most rigid tests before leaving the factory. Each lamp must measure up to standards of voltage, candle power, and watts consumption.



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Northern Lights are made with Tungsten Filament Carbon Filament Metalized Carbon Filament

They can be furnished in regular **Pear Shape**, **Round Bulb**, and **Tubular**, with **Standard Edison**, **Candelabra** or **Miniature Base**.

For the protection of the purchaser each lamp has the words "**Northern Lights**" as well as the candle power and voltage etched on each bulb.



110 v. 25 w. Tungsten Filament



110 v. 25 w. Tungsten
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We guarantee each lamp for **voltage, candle power, efficiency and life**, and will replace any lamp which proves defective either in quality or workmanship.

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The above machines are suitable for 550 volt, 3 phase, 60 cycle Current.

x—Complete with rails—pulley and Star Delta Starter.
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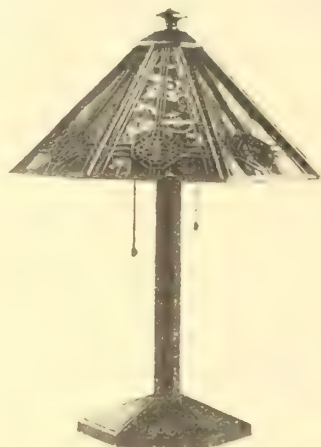
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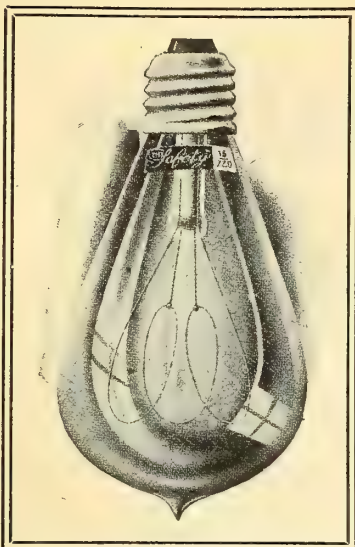
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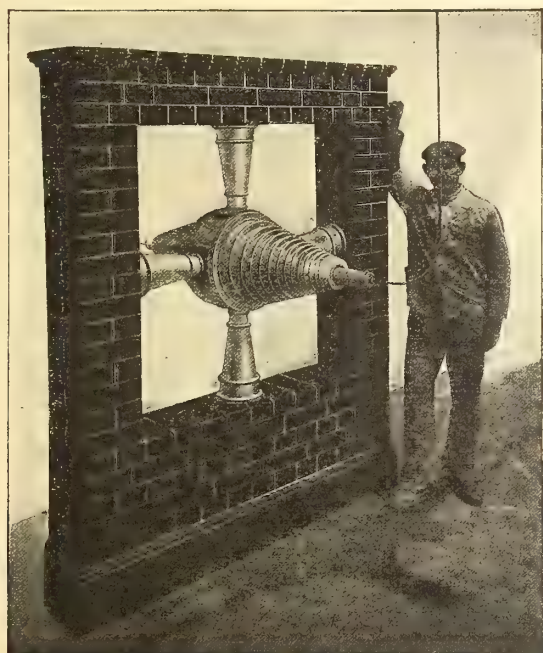
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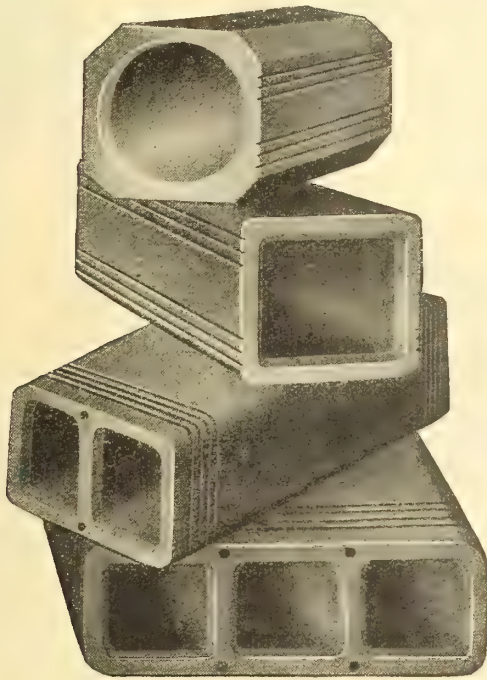
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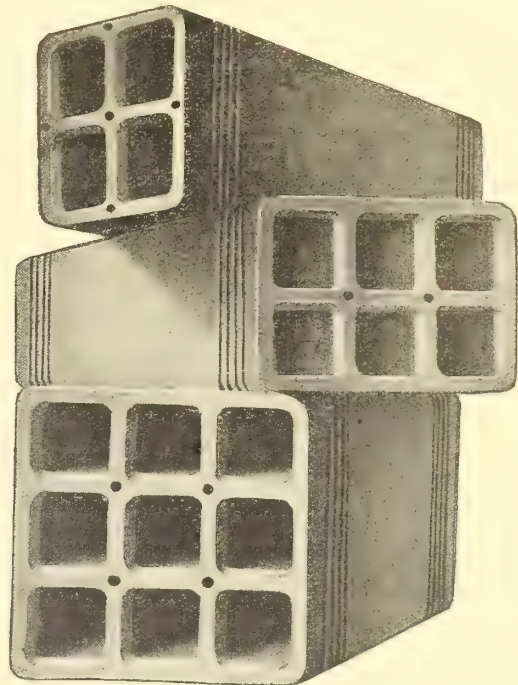
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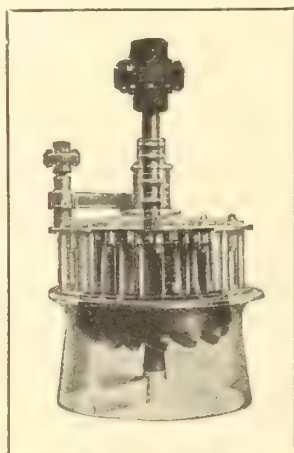
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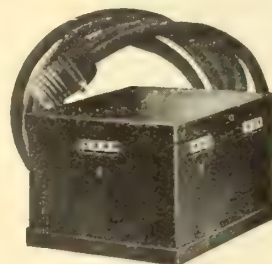
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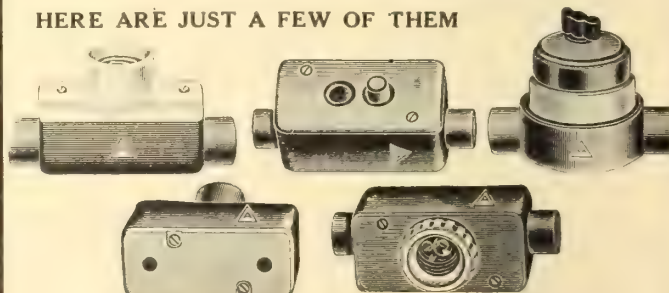
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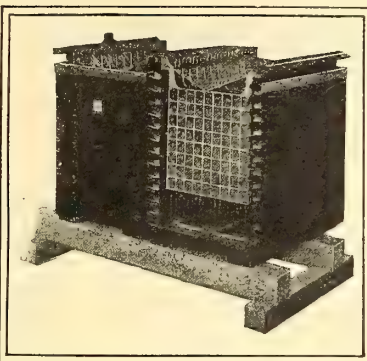
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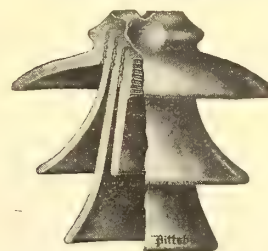
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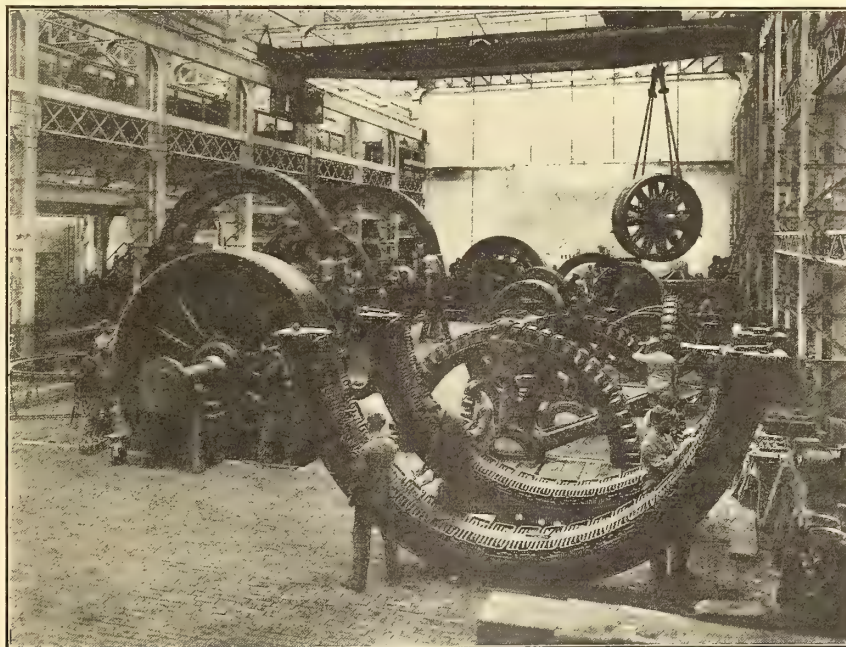
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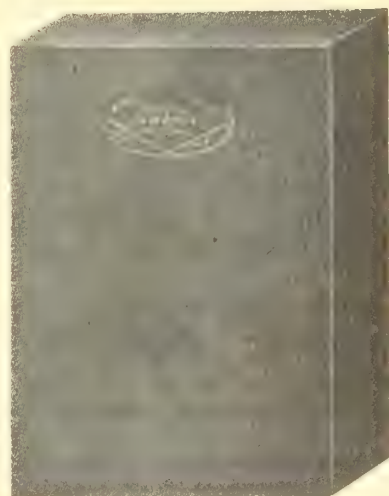
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up to 500	15—25	.0024	A	A1	A2	A3	A4	A5	A6	Carbon
"	20—30	.0021	B	B1	B2	B3	B4	B5	B6	"
"	25—35	.0018	C	C1	C2	C3	C4	C5	C6	"
"	30—40	.0015	D	D1	D2	D3	D4	D5	D6	Semi graphitic
"	35—45	.0012	E	E1	E2	E3	E4	E5	E6	"
"	40—50	.0009	F	F1	F2	F3	F4	F5	F6	Graphitic
"	45—55	.0006	G	G1	G2	G3	G4	G5	G6	Very graphitic
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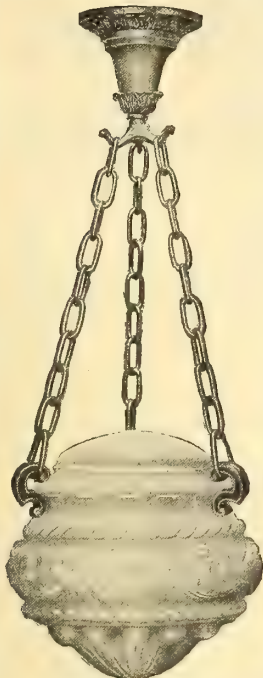
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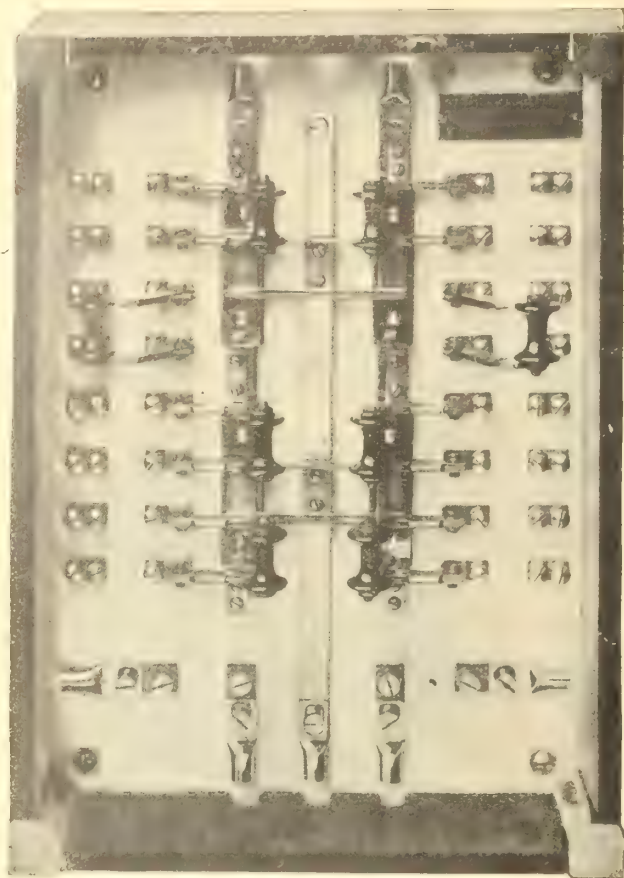
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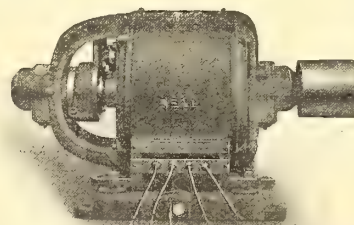
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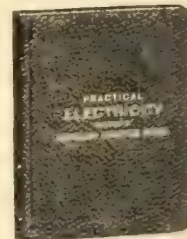
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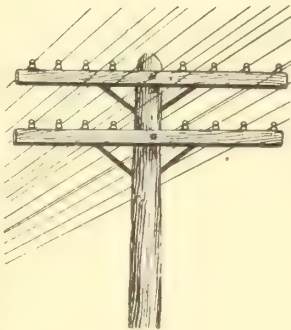
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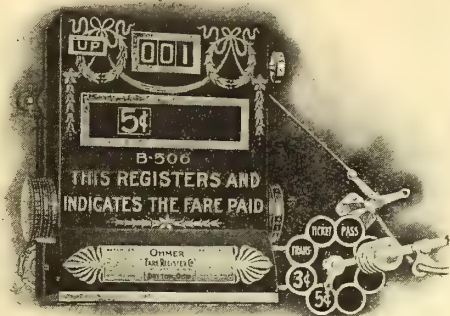
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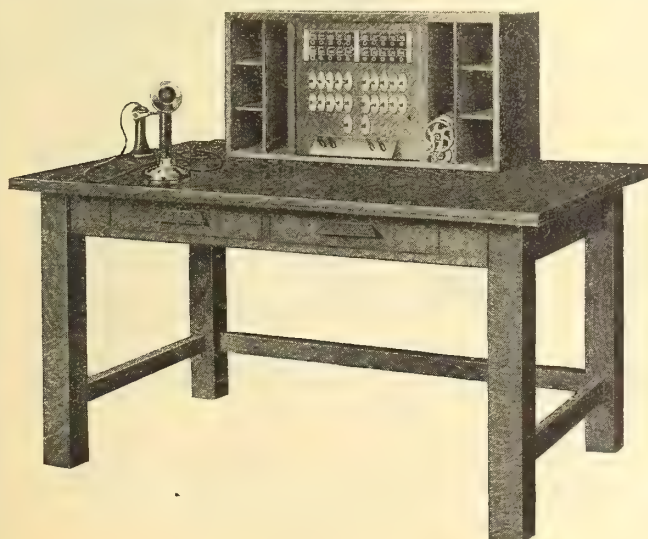
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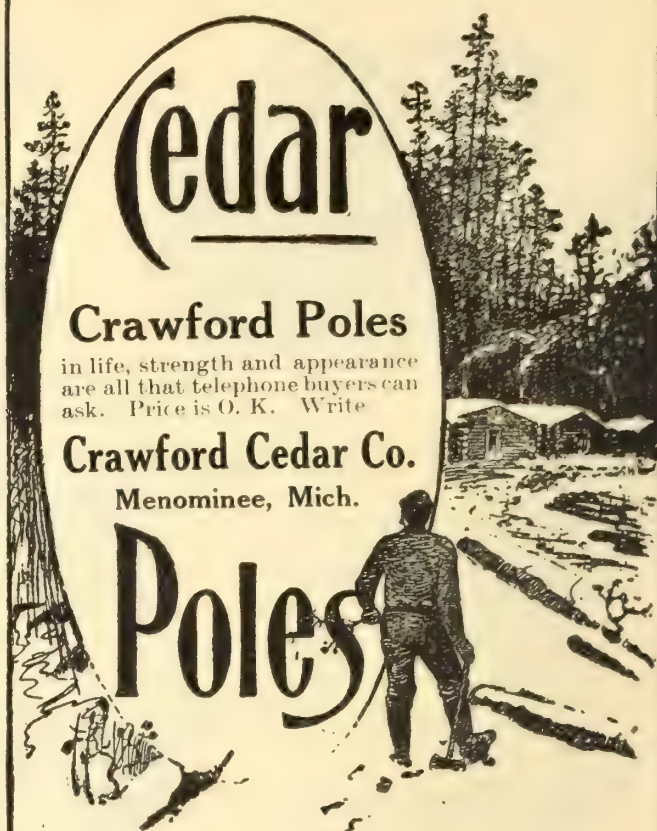
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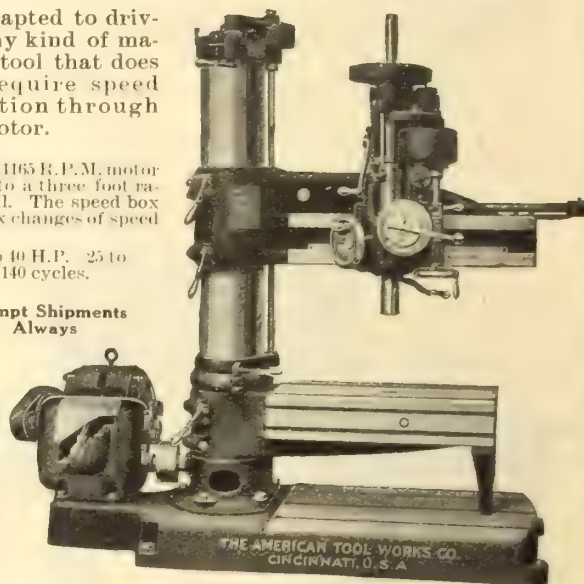
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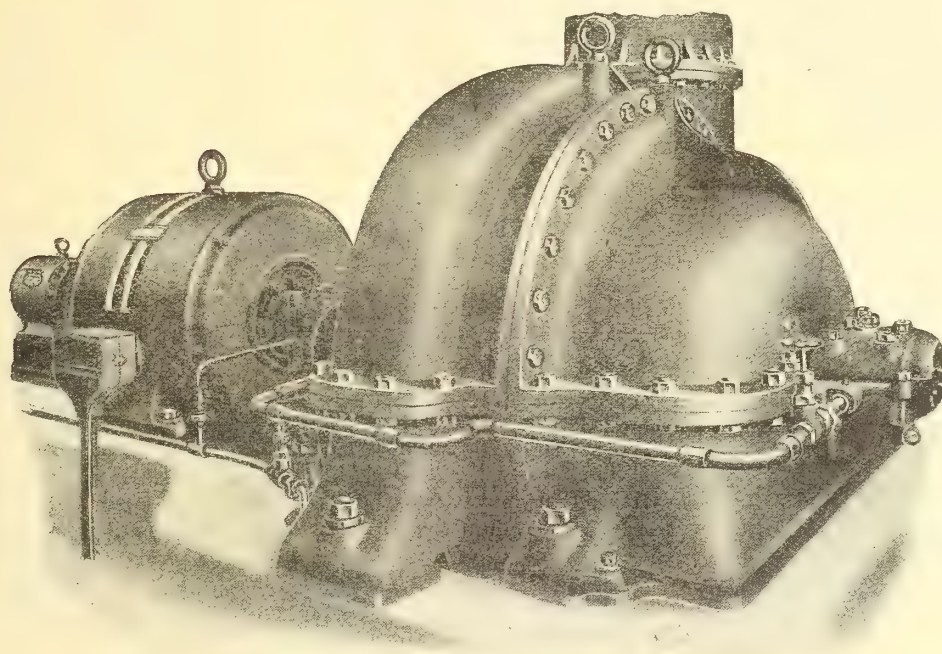
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WHAT TRANSFORMER EFFICIENCY MEANS TO ANY POWER SYSTEM

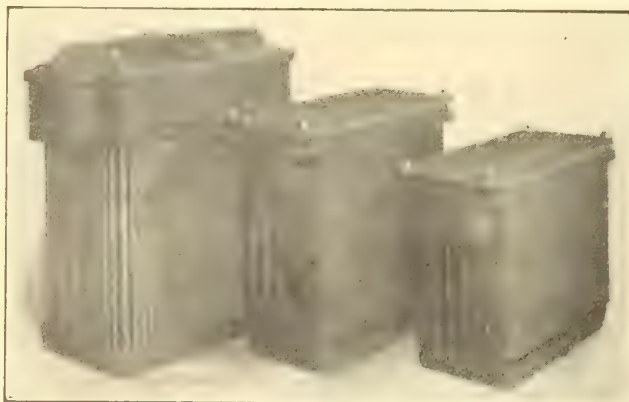
A reduction of energy-loss in a power line is a matter which is always occupying the attention of its engineers and the many points in the system where loss occurs, are subject to continual attention, careful calculation and severe scrutiny.

Among those "loss" points, the transformer loss stands out as one of the most important, and therefore one requiring every consideration.

The Loss of Energy in a Transformer May Amount to Anywhere from 2% to 20% of Input. This Illustrates the Difference Between a Good Transformer and a Poor One

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Ferranti Pole-Type Transformers

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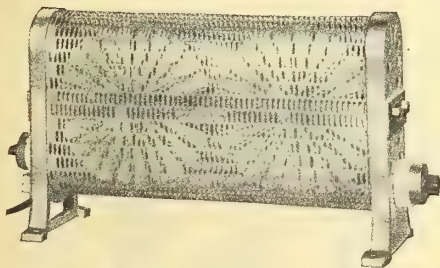
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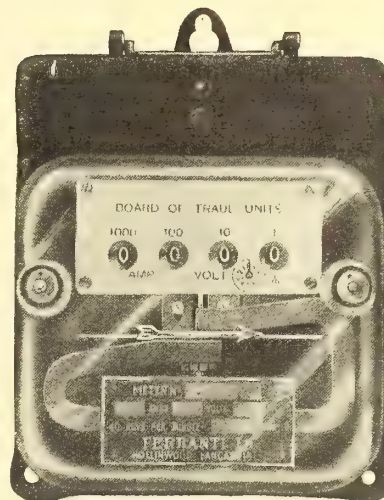
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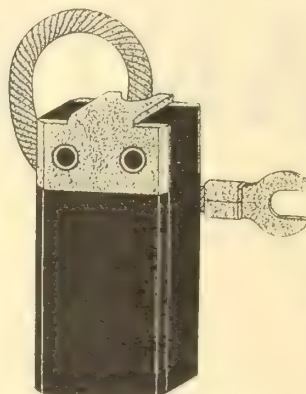
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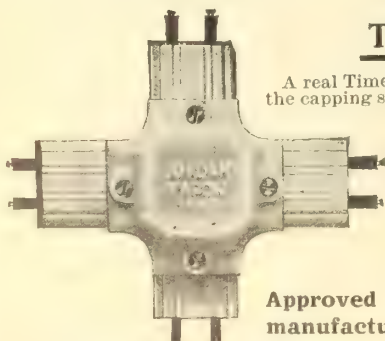
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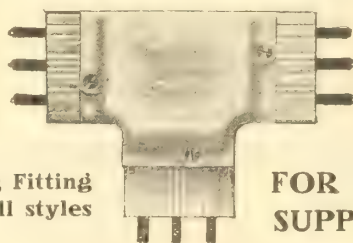
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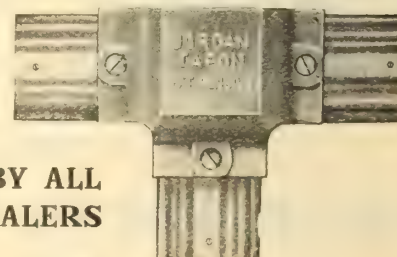
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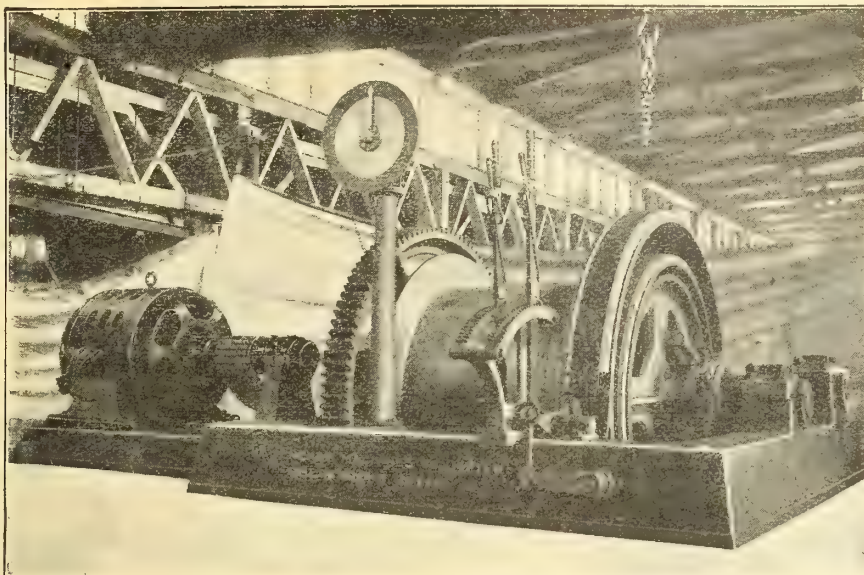


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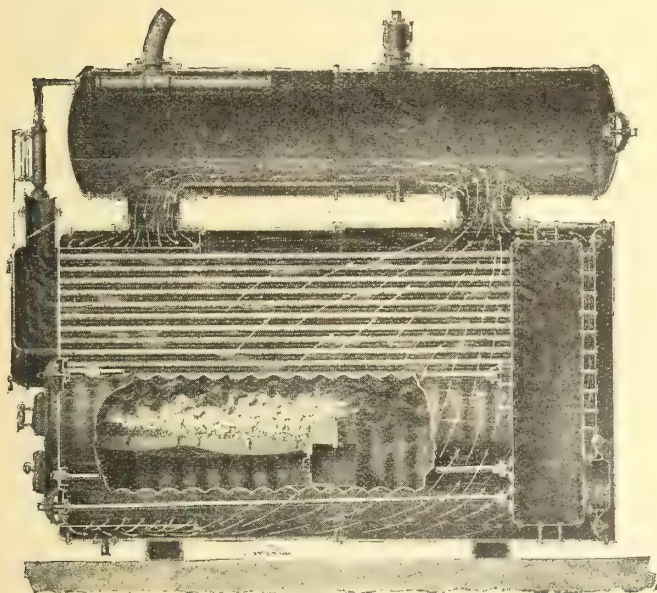
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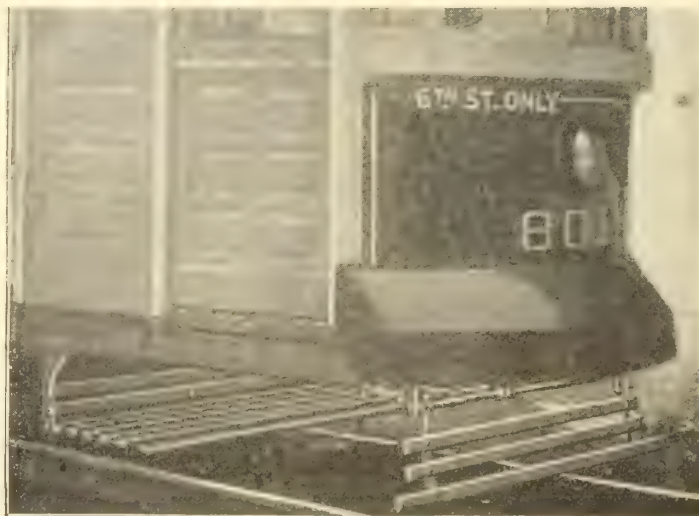
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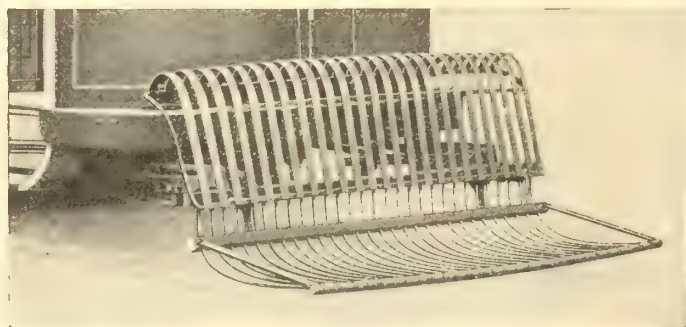
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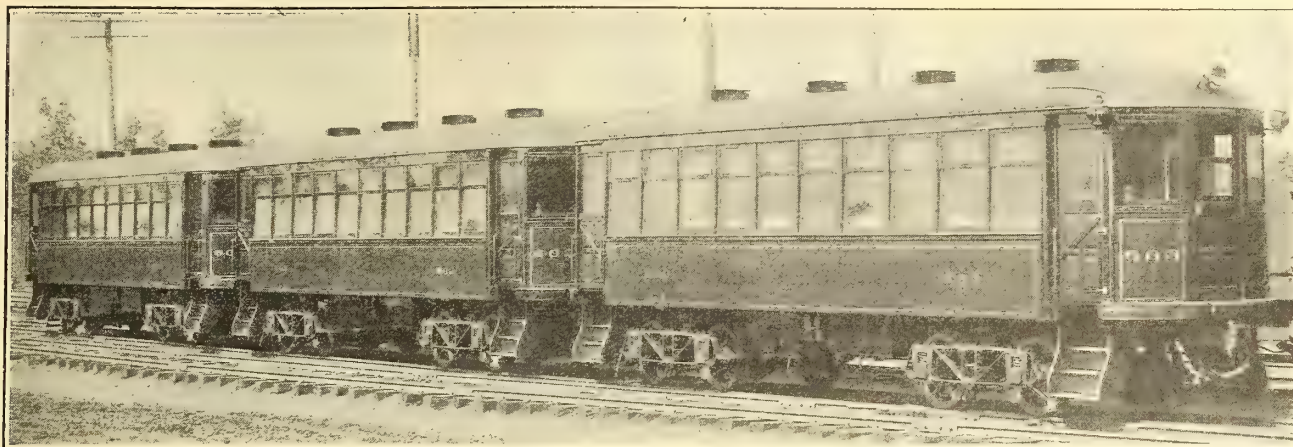
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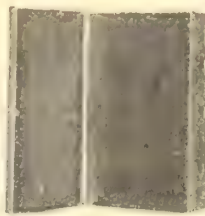
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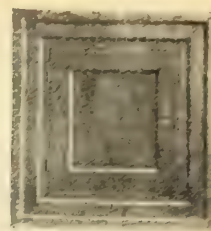
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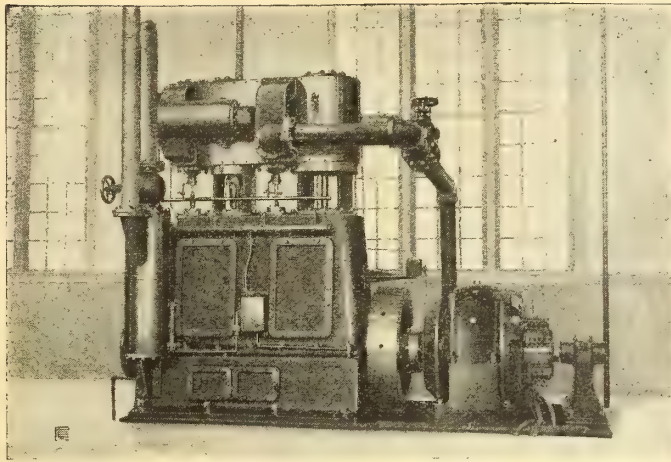
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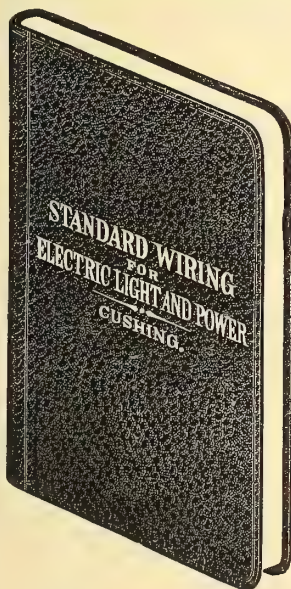
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No. 381-L: Is of the pattern of No. 381, but made lighter than the standard weight. Made only up to 17 inches long.

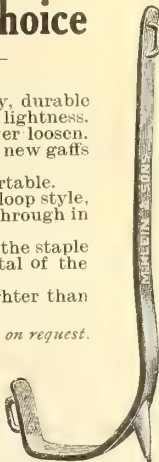
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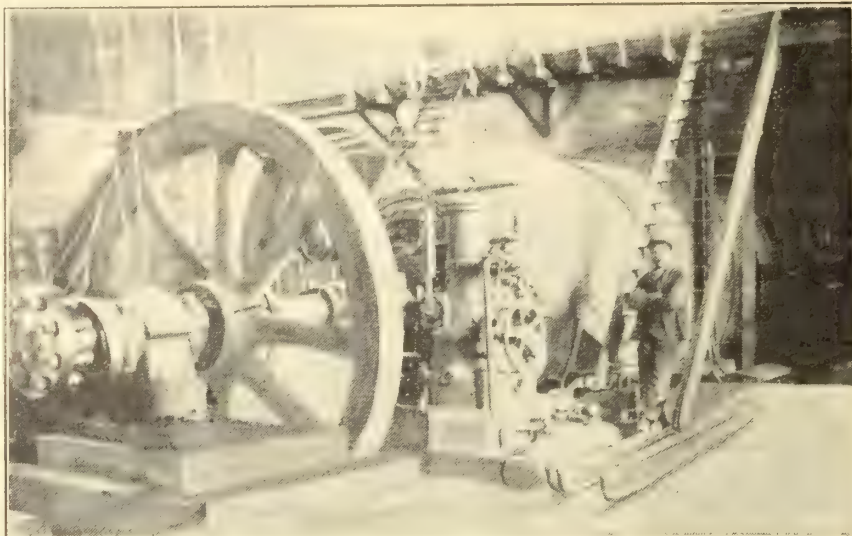
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The illustration shows one of the two 3,750 B.H.P. Turbines and Oil Pressure Governor Supplied to the Calgary Power Co.

Turbines

— and —

Governors

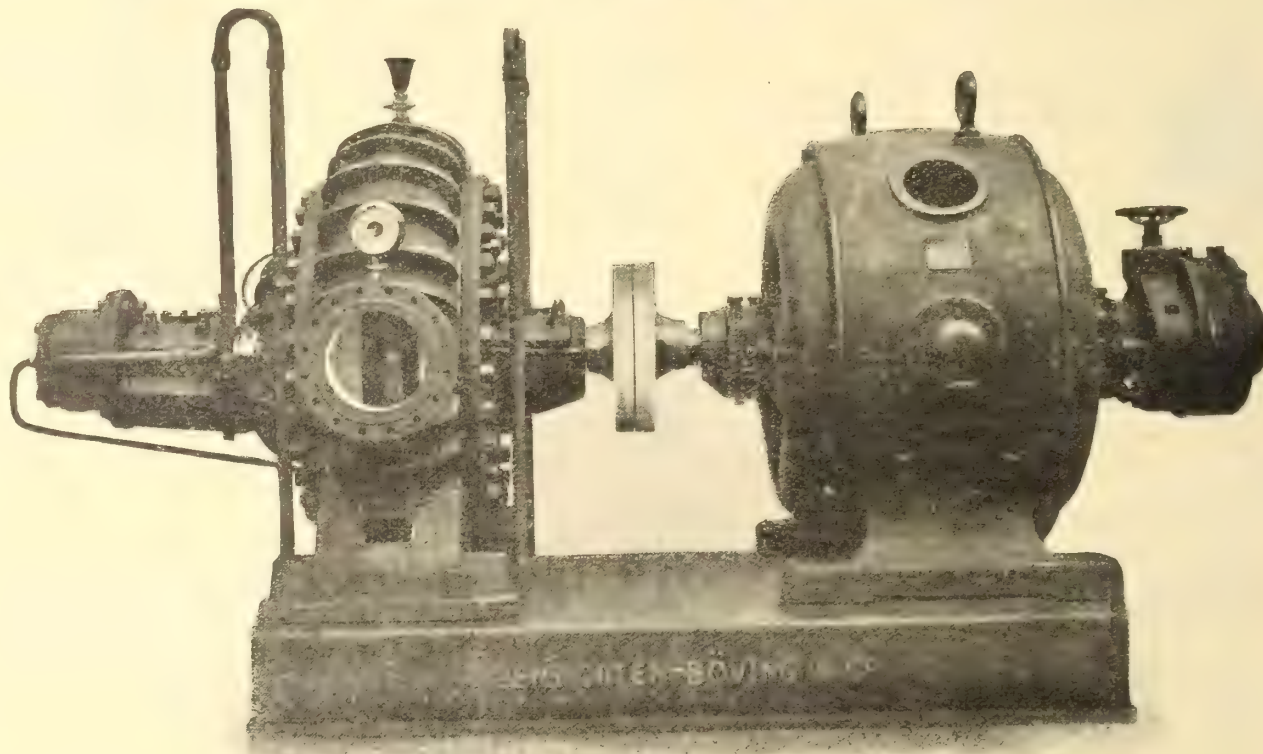
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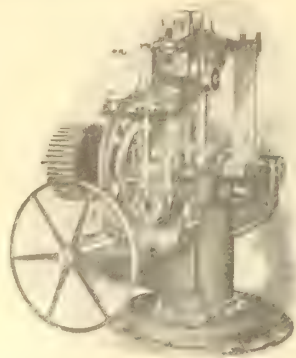
This guarantee is issued with every McEwen Engine we sell and we have never been asked to meet it yet.

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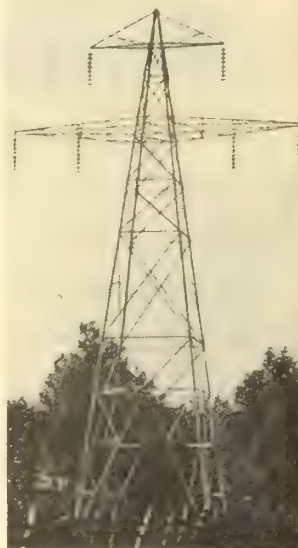
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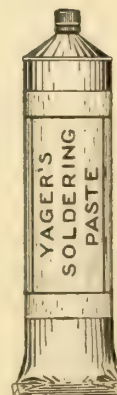
4 Forms—1 Result A Perfect Joint

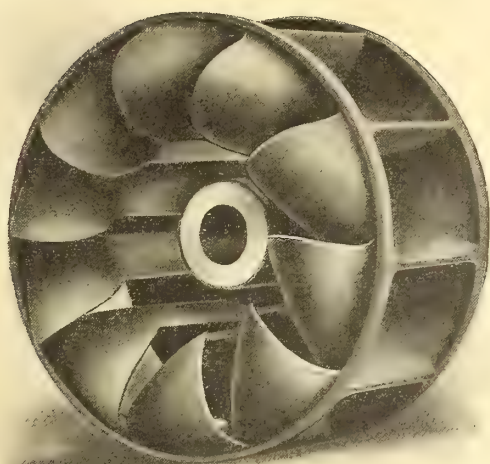
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Normal in speed and discharge,
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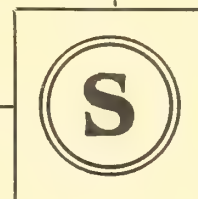
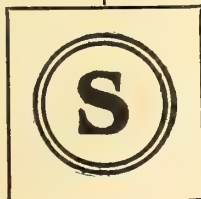
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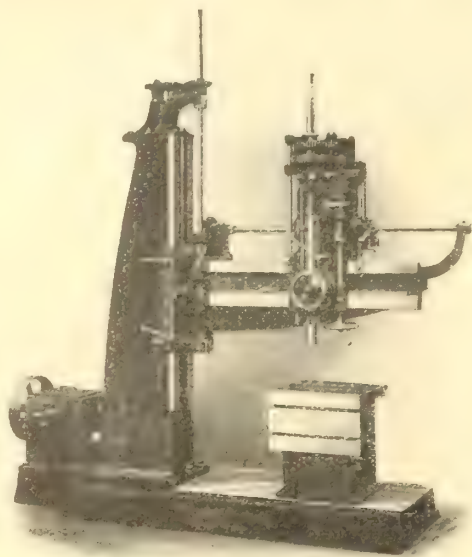
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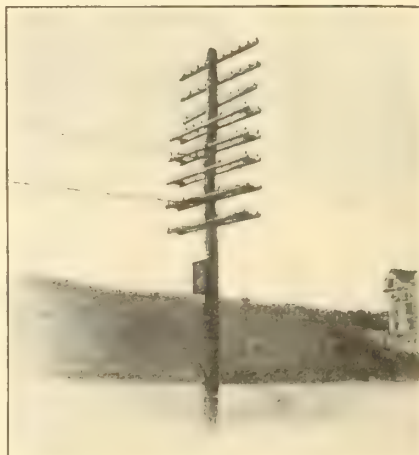
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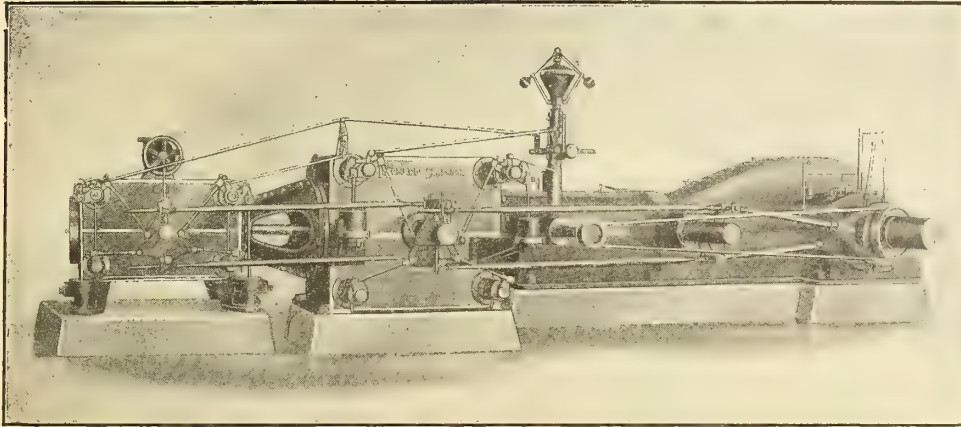
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for Medium and
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Built in Units up
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These engines are
Absolutely Noiseless,
are of **Massive Design**
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The **Frame**, including guides and main bearing, is cast in one solid piece, thus insuring greatest rigidity. **High Economy** is the particular feature of this engine.

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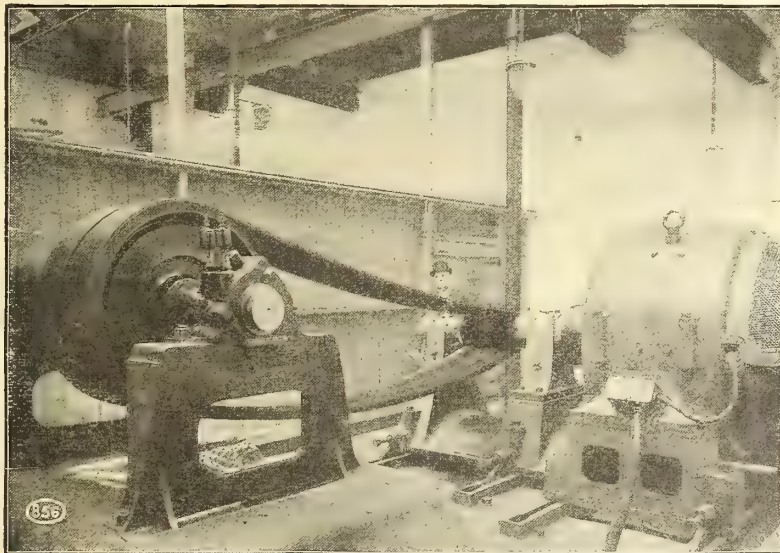
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180 H.P. Renold Chain drive from Motor to Lineshaft in Textile Plant

98.2% Efficiency
Absolutely Reliable

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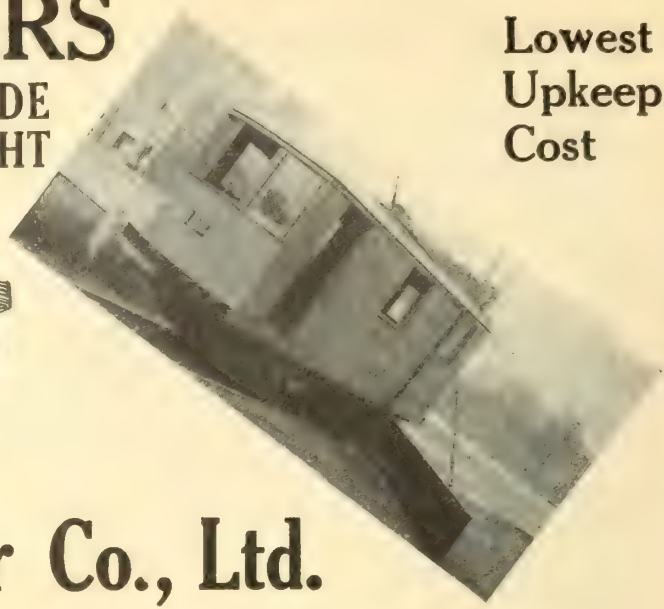
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We stock Chain and Repairs

Highest
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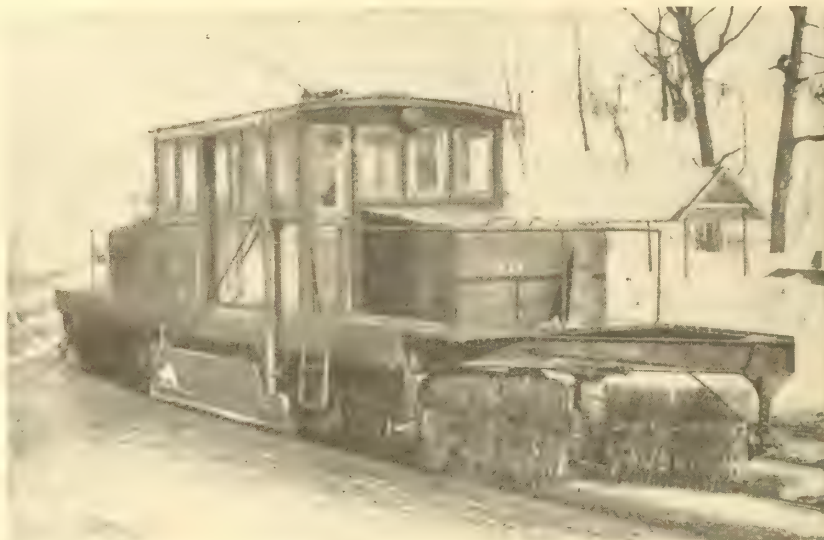
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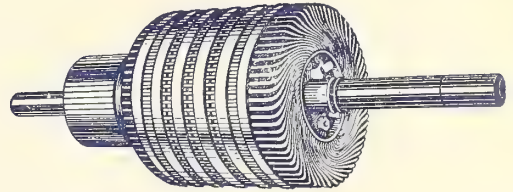


**Continuous work
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their worth**

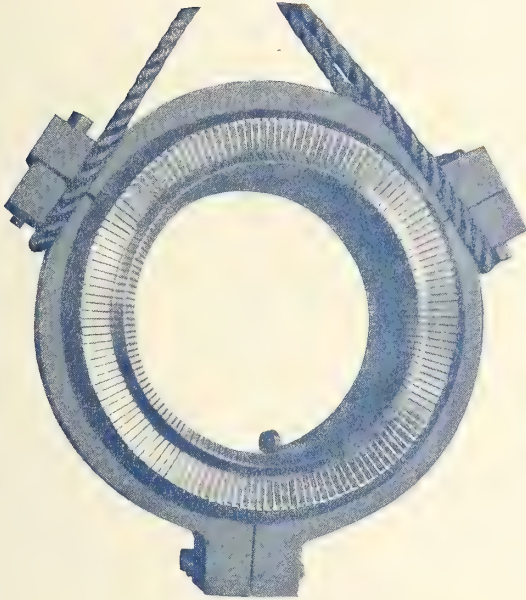
Remember the Address: **COR. KENT AND SLATER STS., OTTAWA, ONT.**



Here's a Message Several of them



If you don't like the one addressed to you, look over the other fellows shoulder and read his, it may suit you better



To the Central Station Man :

Your heavy loads are coming on now. Any defects in your Generating or Transforming equipment overlooked in the summer will show up now and you'll want them **fixed in a hurry.**

For **You** we have a staff of experts available at a moments notice for out of town repairs. They can repair anything Electrical you have, either at the Job or the shop.

To the Consulting Engineer :

Many municipalities are considering electrical illumination and are calling on you for advice.

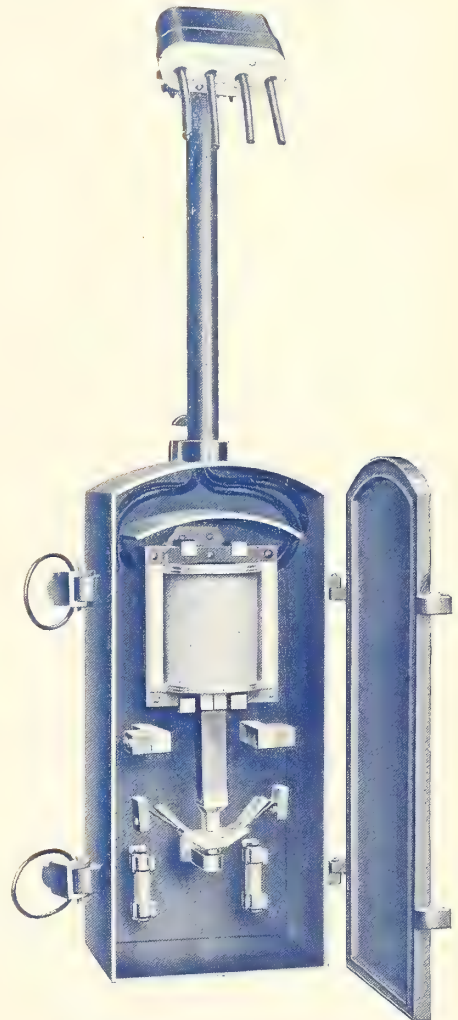
For **You** we have the Remote Control Solenoid Switch as illustrated.

The carbon auxiliary contact has been greatly improved since this cut was made, and in its new form, the switch has been officially adopted by the Ontario Hydro Commission. It's in use in a large number of towns. Advise the installation of this Switch, you will have a superior up-to-the-minute system, giving an absolutely reliable multiple tungsten lighting system with the lowest possible initial and maintenance expense. Write for information.

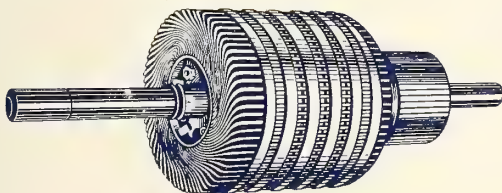
To the Railway Man :

You always have your troubles. Your machines are subjected to the hardest possible service. You're looking for a remedy, something that will insure a minimum of breakdowns in your motors. Some of you have found it. We're It.

For **You** we have made a study of operating conditions and turn out an armature that you can swear by. We don't spare expense and we charge you for it, but you have the satisfaction of knowing that your car is on the road earning dividends and not anathemas.



HOW ABOUT IT

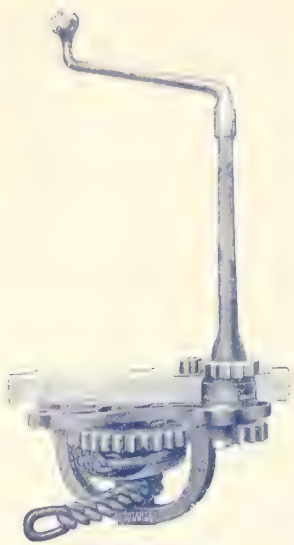


The
**Electrical Maintenance
& Repairs Co., Limited**

162 Adelaide St. West, TORONTO

Long Distance Phones, Adelaide 902, 903





The Ackley
Adjustable Brake

The Strength of a Car

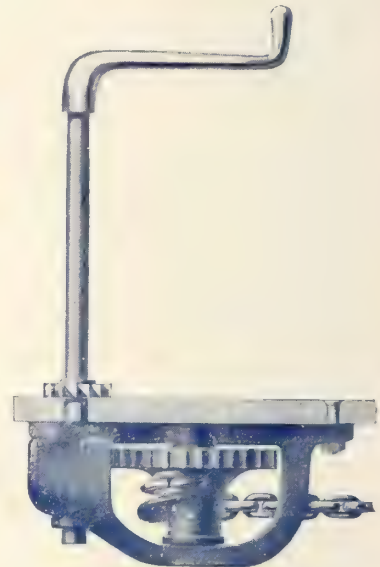
and its capabilities of avoiding accident is just the relative strength and efficiency of its Brake.

It is in cases of emergency that the equipment of the car receives the hardest test and however well a car is built, **the prevention of accident is never certain** unless you can **be certain of the brake.** The money paid to equip cars with

Peacock & Ackley Adjustable Brakes

covers not only the cost of brakes that will work better, wear harder, live longer and give less trouble than any other hand brake on the market.

It also covers a very valuable insurance against the claims which are the inevitable result of nearly every accident—an insurance which is the prevention of the accident. It will pay you to equip your cars with Peacock & Ackley Adjustable Brakes:



The Peacock Brake

Peacock & Ackley Adjustable Brakes

are made to fit any size and every make of car—will hold perfect control of the car at all times and under all conditions. No complicated Brake Rigging. The eccentric cam on the drum takes up the slack—the gearing ensures a quick but even and steady pull or retard on the car, making impossible the gripping, jarring and skidding consequent to a sudden application of the brakes. Moving parts all turn on roller bearings, giving easy operation, minimum friction and longest wear. Both Brakes are protected by Canadian Patents and Brakes for Canadian use are manufactured in Canada. They are therefore sold free of duty at the same prices as are paid in the United States. When ordering new cars specify Peacock & Ackley Adjustable Brakes then notify us—we will do the rest. You will then be certain of having the very best Brake Equipment it is possible to obtain throughout the entire market. Write for full particulars.

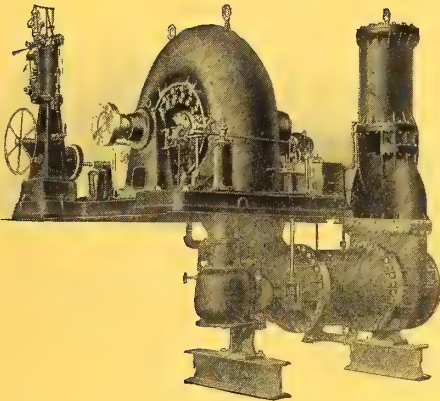
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National Brake Company

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Electrical News

Generation, Transmission and Application of Electricity



HYDRAULIC TURBINES

One of three units each of
1700 H. P. at 720 R. P. M. 280 ft. Head

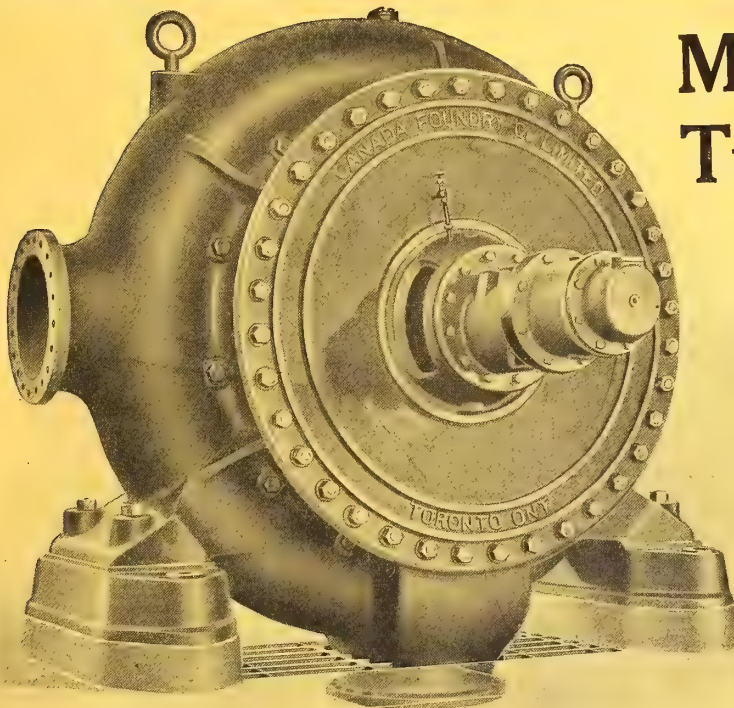
These wheels when tested in place gave over
87% efficiency.

We are now building five 16,000 H. P. units
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Branch Offices: 167 Federal St., BOSTON, MASS
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Mather & Platt Turbine Pumps

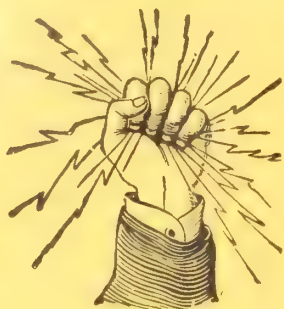
Over 100 of these
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supplied by us
during the past
year, from Mather
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and built in Can-
ada.

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small pumps.

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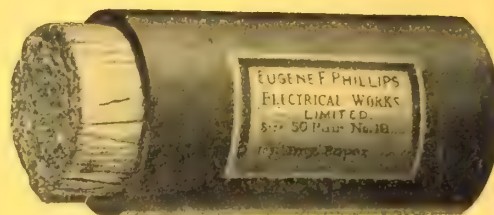
PHILLIPS



Bare and Insulated Copper

WIRES AND CABLES

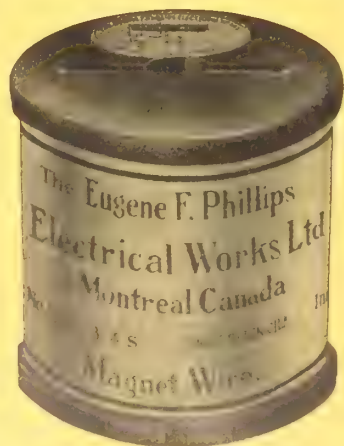
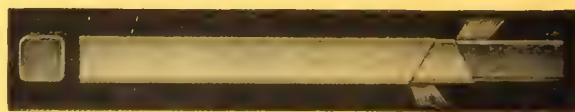
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Bare and Insulated Electric Wire and
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Railway, Feeder and Trolley Wire

Weatherproof Magnet
and Rubber Covered
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Incandescent and Flexible Cords

Eugene F. Phillips Electrical Works, Limited

MONTREAL

CANADA

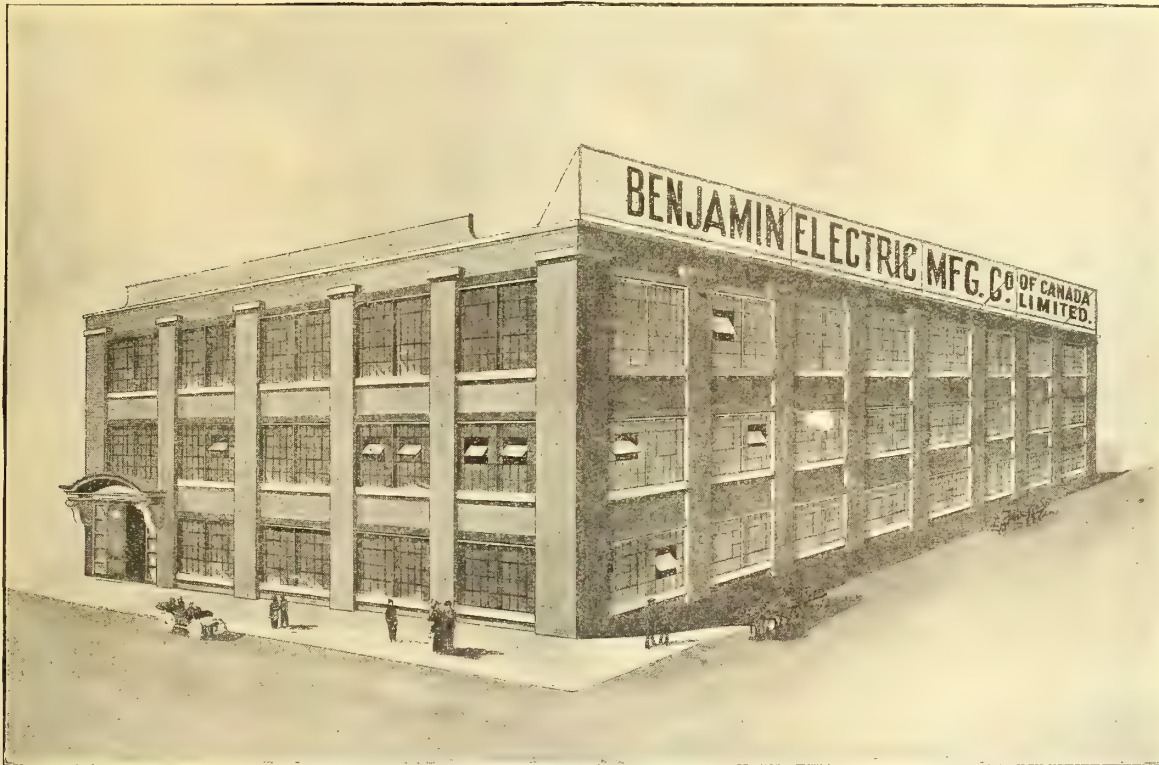
Branches: Halifax, Toronto, Winnipeg, Vancouver

We beg to announce to the

Canadian Electrical Trade

that we are now located in our new factory

11-17 Charlotte Street, Toronto



Our increased floor space and up-to-date facilities and machinery means that we will serve you even better than heretofore.

Many new devices are under course of construction and our new catalog C-21, to be issued in January, will list and describe them fully.

Send in your name for a copy.

Benjamin Electric Mfg. Co., of Canada,

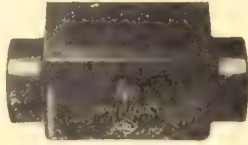
Limited

11-17 Charlotte Street

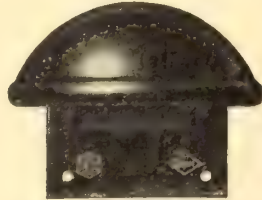
TORONTO

Railway Condulets

Selections From an Entirely New Line



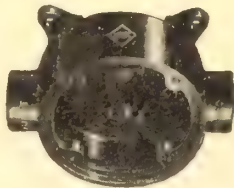
Type JRY—For use back of Car Molding with Rectangular Base Fittings or Fixtures. Arranged to take Terminal Block



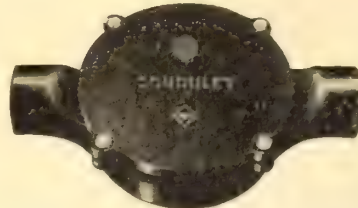
Type JRRH Side Bracket Hood—For use with type JRR Condulet. Takes various Round Base Fittings



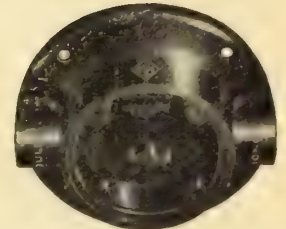
Type JRR—For use back of Car Molding with Rectangular Base Fittings or Fixtures. Arranged to take Terminal Block



Type LOBC—For use with Center Ceiling Fittings. Arranged to take Terminal Block



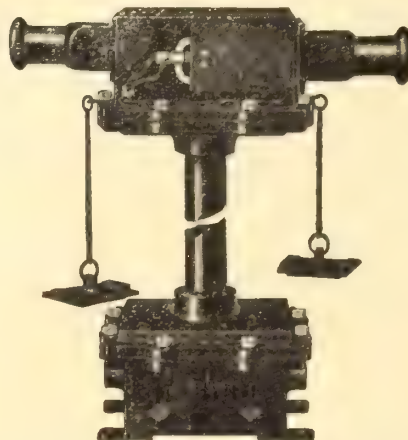
Type PRC — Medium size. Weather-proof Junction Box



Type CLOC—For use with Center Ceiling Fittings. Arranged to take Terminal Block



Type BLMC—For Bracket Lamp Outlets. Takes Round Base Fittings



Type UGC with Receptacle Housing, 100 Ampere Receptacles and Plugs—Yard Charging Condulet. Arranged for Underground Conduit Installation



Type DSOC—For Deck Sill Outlets where Conduit is back of Molding. Takes Round Base Fittings and Terminal Block

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Crouse-Hinds Company of Canada, Limited



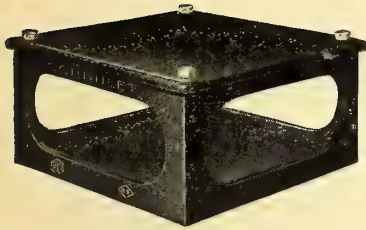
Main Office and Works:

Toronto, Ont., Canada



Railway Condulets

For Coaches, Shops, Round-Houses and Yards



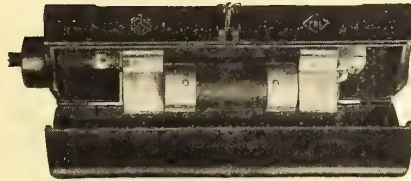
Type RS — Detachable-sides, Weather-proof Junction Box. Blank Metal, One-hub and Two-hub Side Plates are Interchangeable



Two-hub Side Plate for Type RS Condulet



Type UGC—Extra heavy, Weather proof Junction Box



Type FBL—Weather-proof Housing for 100 to 200 Ampere Fuse on Battery Circuit



Type MD—Receptacle and Plug for connecting and disconnecting wires from Dynamo to Regulator



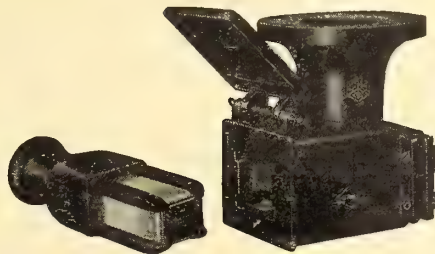
Type RQ Plug, 30 Ampere — For use with Type RQK Receptacle



Type PJCA—Medium size, Weather-proof Junction Box



Type TJ—For use with Telephone Jacks. Has Swivel Base



Type BRHS with 100 Ampere Receptacle, Swivel Base and Self-closing Cover. Type BP Plug for type BRHS Condulet. Battery Charging Equipment for Car



Type RQK Receptacle, 30 Ampere, in type QKA Condulet

Write for Bulletin No. 101

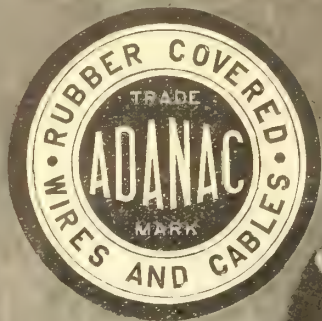
Crouse-Hinds Company of Canada, Limited

Main Office and Works:

Toronto, Ont., Canada



ADANAC Red Core Rubber Covered WIRES & CABLES



Adanac Red Core Rubber Covered Wires and Cables

are made according to the specifications of the National Board of Fire Underwriters. The conductors are drawn from copper of the highest conductivity and are covered with two thicknesses of thoroughly vulcanized rubber compound of high quality. The wires are braided over insulation and the smooth high finish they receive makes them specially desirable for conduit work.

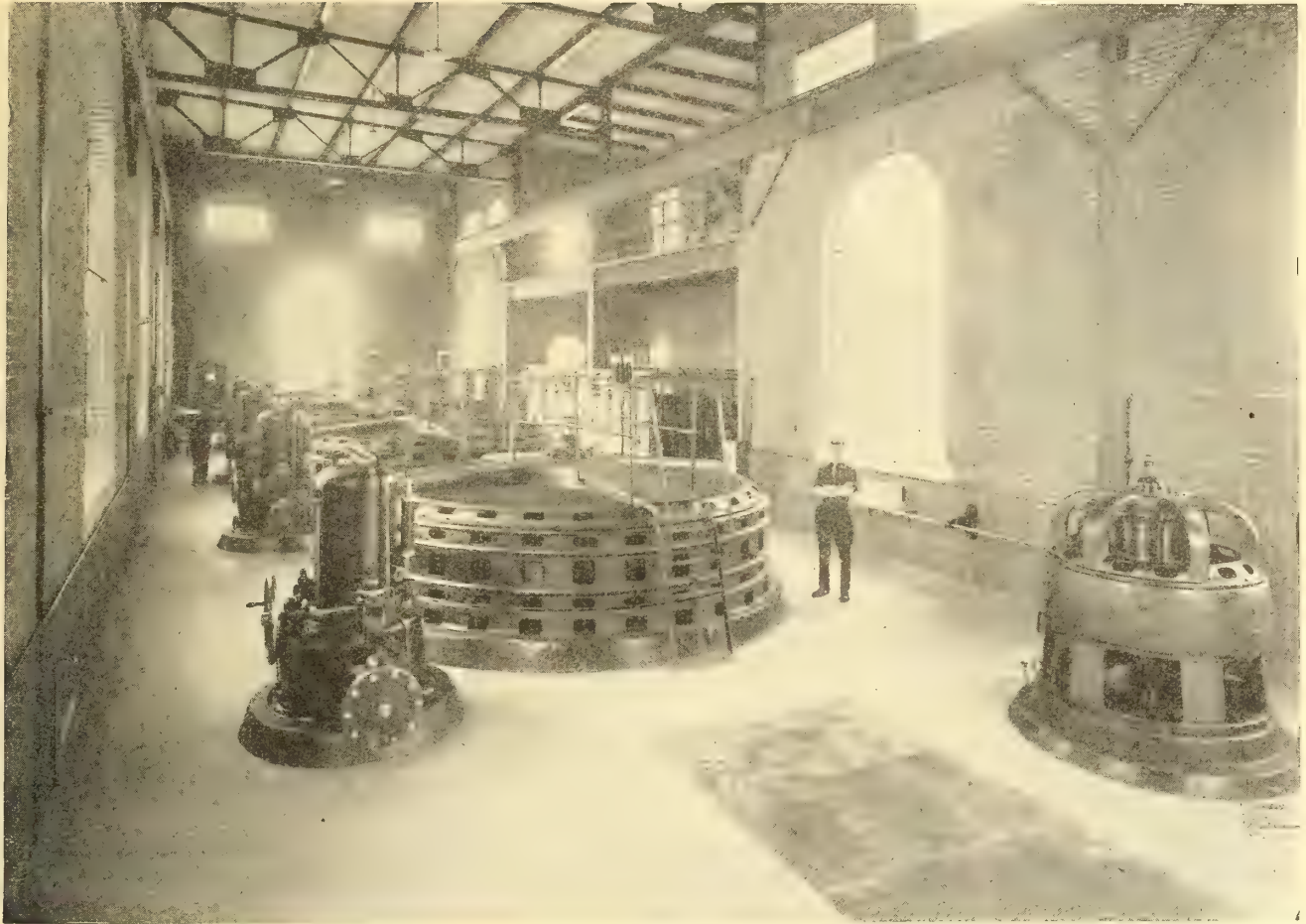
IMPERIAL WIRE & CABLE COMPANY Limited MONTREAL

THE *Northern Electric*
AND MANUFACTURING CO. LIMITED
SALES AGENTS

TORONTO
CALGARY

WINNIPEG
REGINA
VANCOUVER

High Grade Electrical Apparatus



4-937½ K V A 6600 volt 3 phase 60 cycle 120 R P M Vertical Generators for Sidney Electric Co., Dam No. 2.
Duplicate plant now being installed.

Kilmer, Pullen & Burnham, LIMITED

Head Office,
TORONTO



Branch Offices: MONTREAL
General Supplies Ltd.,
CALGARY, ALTA.

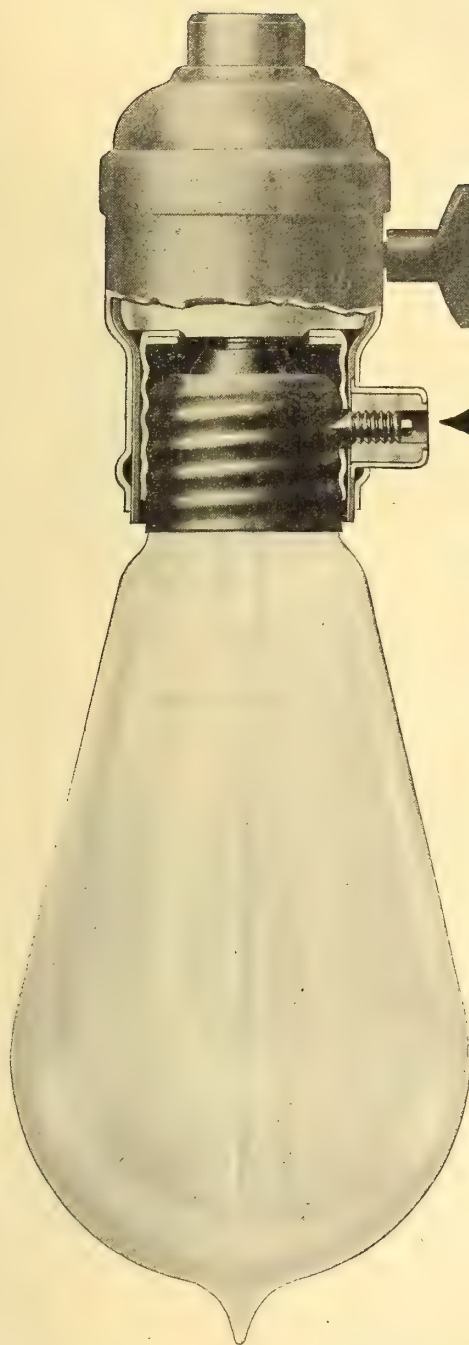
SOLE DEALERS FOR
The General Electric Co., of Sweden

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The Advertisements in the "Electrical News" represent the leaders in their line

Know the Saving



Have you any customers who hesitate to install Mazda or Tungsten lamps due to the danger of theft?

If so, you can assure them that the lamps will not be stolen if they put these lamps in P & S **Shurlok** — the socket that locks.



THE **Shurlok**

makes it possible to use Mazda and Tungsten lamps in every place—to use them effectively and economically. Theft is absolutely prevented and troublesome guards done away with.

FOR SALE BY ALL JOBBERS

CARRIED IN STOCK BY:

Dawson & Company, Limited	Montreal
Central Electric & School Supply Company	Toronto
James Stuart Electric Company	Winnipeg
Mainer Electric Company	Winnipeg
Dawson & Company	Winnipeg
Cope & Son	Vancouver
Mechanics Supply Company, Limited	Quebec
St. John Railway Company	St. John N. B.

HOW IT WORKS

The illustration herewith will demonstrate how simple the device is and yet how difficult it would be to unlock the socket without the proper key.

The lamp is shown locked in place. The head of the set screw locking the lamp in place is of a peculiar triangular shape, deeply recessed, so that it cannot be reached with tools. The key is sold separately from the socket and is only sold to those properly entitled to possess one.

The distribution of the key is safe-guarded in every possible way. There are no other keys on the market just like this, and it is not possible to operate the lock with an old style watch key.

PASS & SEYMOUR, INC.

Main Office and Works: SOLVAY, NEW YORK, U. S. A.

NEW YORK CITY, 178 Fulton Street SAN FRANCISCO, Rialto Building
CHICAGO, 700 West Jackson Blvd.
DENVER, SALES AGENTS—B. K. Sweeney Electrical Co.

Pass & Seymour, Inc.

Solvay, N.Y.

Please send us sample of Shurlok Locking Socket without expense to us. Send your catalog too.

Name

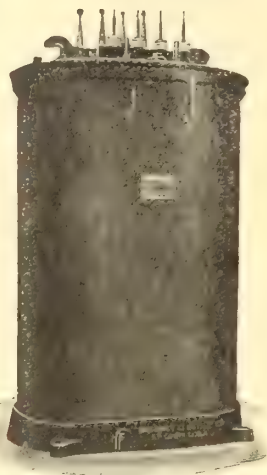
Address

City

State

Coupon No. 44

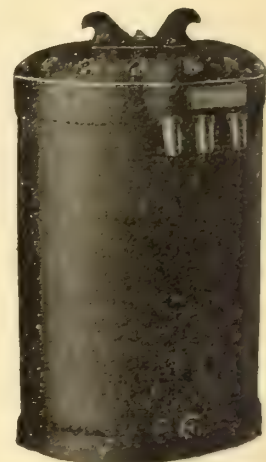
Energy-Loss Saved is Money Made



Water-cooled Transformer
Front View

and the Transformers that will give a maximum 2% energy-loss instead of—the quite usual—20% energy-loss are making money for the power line that installs them, every hour of operation.

Moloney High Efficiency Transformers



Subway Type Showing
General Appearance

effect a clear saving of 18% of input over any "ordinary good" transformers. This means a **direct saving of money** throughout the transformer operation.

Their manufacture of the **very best Silicon Steel** ensures **less core loss** and **long life**—this means **low upkeep cost** and **highest commercial value**.



Interior view Type H. E. Transformer Coil Core. Note small parts

Do You Use Transformers?

Moloney High Efficiency Transformers give the **highest possible returns on your Transformer investment**. We will prove it.

Shall we send our Catalogue?



Type C. Transformer

Canadian Moloney Electric Co., Limited

Office and Works: WINDSOR, ONT.

DISTRICT OFFICES:

512 Canadian Express Bldg., MONTREAL
616 Continental Life Bldg., TORONTO

606 Granville Street, VANCOUVER
21 Scott Block, WINNIPEG

COMPLETE STOCKS:

WINDSOR

WINNIPEG

VANCOUVER



"STANDARD" QUALITY



You Pay for Good Wire

whether you use it or not. If you buy a wire "made to meet a price", you may pay several times the cost of good wire in replacing your defective wiring or the building in which it was installed.

"Sterling" Rubber Insulated Wire

is made to maintain a standard, not to meet a price. The price is, however, as low as that for which a product of equal quality can be successfully sold.

This standard is a self-imposed one because "Sterling" might meet all N.E.C. specifications and tests with a much lower quality than it possesses. A higher quality than required is voluntarily maintained because the slight increase in cost is more than made up by the greater durability and economy secured.

Our new booklet, "STERLING", gives valuable information about rubber covered wire. It will be sent on request.

Standard Underground Cable Co. of Canada, Limited

Department E

Hamilton, Ont.

Manufacturers of Electric Wires and Cables of all kinds, for all services, also Cable Junction Boxes, Terminals, etc.



"STANDARD" ECONOMY



NULITE

(REGISTERED)

Genuine Drawn Wire

Continuous Filament Tungsten Lamp

Ask for Samples

Manufactured by

The Canadian Tungsten Lamp Company

HAMILTON - - - ONTARIO

Limited

NULITE

(REGISTERED)

The Latest and Most Improved Tungsten Lamp

On the Market

Pure Tungsten Metal drawn into wire form from which a continuous filament is made, making a Lamp that will stand as much vibration as a carbon lamp.

Others can imitate but none can equal.

Made in Canada by

The Canadian Tungsten Lamp Company

Limited

HAMILTON

ONTARIO

Warehouses at: MONTREAL

TORONTO

WINNIPEG and VANCOUVER

“Galvaduct” and “Loricated”

The Conduits that can be Depended
on for Long and Efficient Service



Arena Gardens, Toronto—A Loricated Building

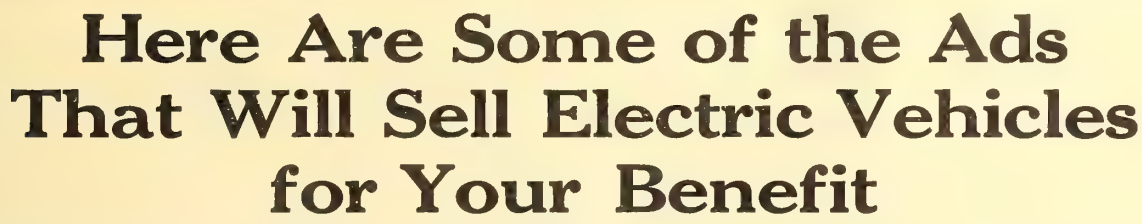
QUALITY AND DURABILITY

are essential features in Conduits. These qualities are found in the highest degree in “GALVADUCT” and LORICATED”.

The work of installing good Conduit costs no more. Besides they eliminate unexpected and often disastrous mishaps.

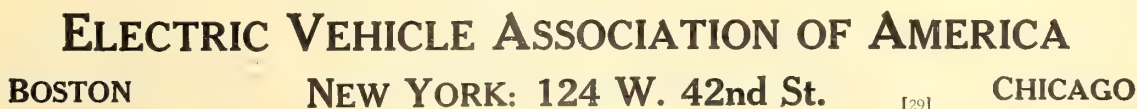
Always specify the Conduits made by

Conduits Company Limited
Toronto and Montreal

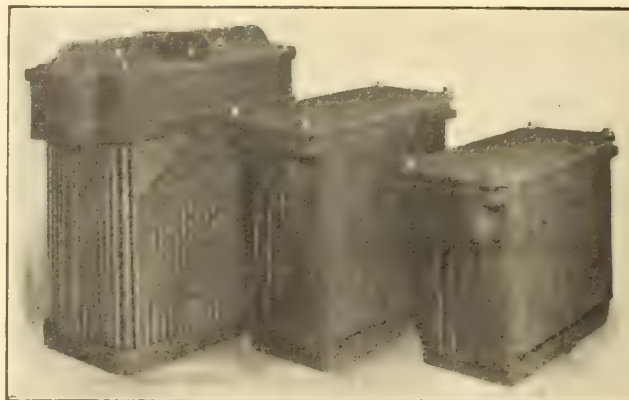


You Know the Advantages of Electric Vehicles – Why Not Tell Others About Them?

Our special plan for securing an Electric Vehicle charging business for Central Stations is at your disposal. It will show you how your Central Station can become part and parcel of our nationwide campaign. Send for it today before you forget.



Transformer Efficiency



Three Phase Pole or Station Transformers

Reduce your Construction Cost
Reduce your Losses
Increase your Efficiency

By using Three Phase Transformers for your power supply. Any other practice is behind the times.

Ferranti Limited have for years made a specialty of three-phase transformers. Our three-phase transformers have many advantages which may be made the means of reducing installation, operating and up-keep costs.

In Ferranti Pole-Type transformers, single and three-phase, we have the most efficient transformer made—with heating, core and copper losses reduced to a minimum. All coils are wound with ample sectional area and are so connected that any out of balance load does not affect the regulation on three wire systems.

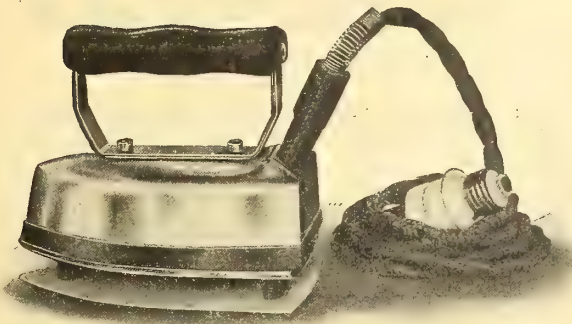
Send us your enquiries

Ferranti Limited

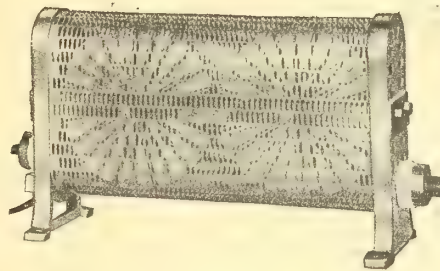
GEORGE C. ROYCE, Canadian Manager

90 Sherbourne Street, - Toronto

YOUR XMAS STOCK?



There are many good points about the Royce Patent Electric Iron that you can "sell" to your customers—points of advantage not to be found in other irons. The heating element in this iron has cut operating and maintenance costs to a minimum. The iron is fitted with a patent connector that forms a perfect contact and cannot work loose.



Like our iron, Royce Patent Economic Electric Radiators are supplied with our efficient heating element, giving low operating cost and long life to the heater. They are strongly constructed, handsomely finished, and equipped for two degrees of heat.

All Economic Electric Heating Appliances are equipped with Royce Patent Indestructible Element. Every element is made to stand a test of 100% overload without burning out.

The most welcome Xmas gifts are those which are most useful and lasting. Electric heating devices make excellent Xmas presents for this reason—and they do not cost very much. Write to-day for our complete illustrated catalogue showing Disc Stoves, Water Urn Heaters, Tailors Irons, Car Heaters, Electric Irons, Electric Radiators, etc. Send us card right now.

ROYCE & CO., 90 Sherbourne St., Toronto

Removal Notice

On and after December 1st our offices and factory will be located in the new Lowes Building, 90 Sherbourne Street, Toronto.

With 8,000 square feet of floor space, we will be in a better position than ever to show our complete line of famous Ferranti meters, transformers and switchboards.

FERRANTI LIMITED

Geo C. Royce, Canadian Manager

90 Sherbourne St., TORONTO, ONT.



TYPE K METAL CASE

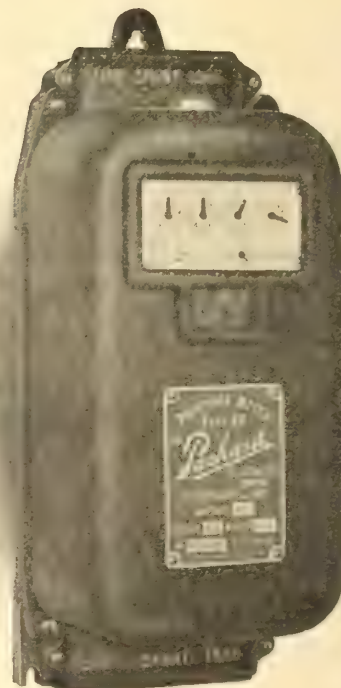
PACKARD METERS

For All Circuits

Always Reliable

Permanent Accuracy

Every Meter Guaranteed



TYPE PK POLYPHASE

Large Stocks at St. Catharines and Winnipeg

St. John Railway Co., St. John, N.B.

General Supplies, Limited, Calgary, Alta.

The Packard Electric Company, Limited

Factory: ST. CATHARINES

General Sales Office
901-902 Traders Bank Building,
TORONTO

N. W. Office and Warehouse
WINNIPEG

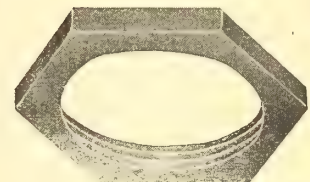
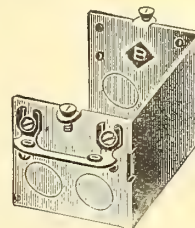
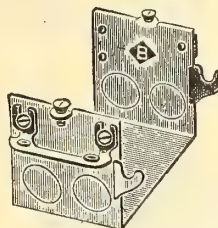
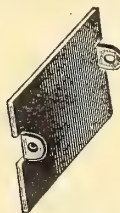
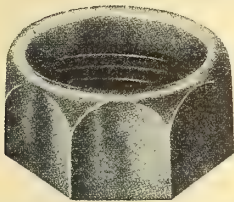
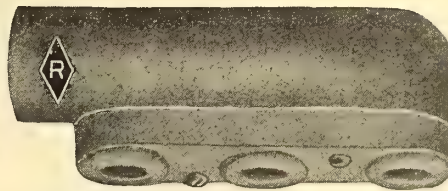
MADE IN CANADA

Conduit Boxes, Conduit Pipe Fittings, Conduit Accessories, &c.

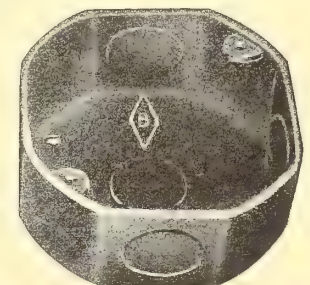
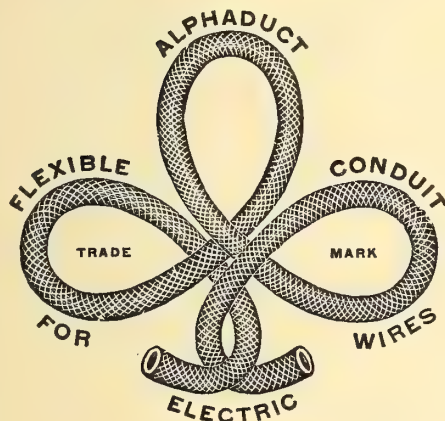
The Pipe
GREENFIELD DUCT
of Quality

GREENFIELD DUCT

Hot Galvanized



Type S C 3" deep—CCS-2" deep
 side comes off and does away with carrying two gangs



Write for
 Catalogue No. 4

Electrical Fittings Co., Limited

70 King St. West - Toronto - Canada

Write for
 Catalogue No. 4

STOCKS CARRIED BY
 Cope and Son, Ltd., 132 Water St., Vancouver, B. C.
 Munderloh & Co., Ltd., Victoria Sq., Montreal.

If your jobber cannot supply
 you, write us. We carry a large
 stock at Toronto Warehouse
 and Guelph Factory.

STOCKS CARRIED BY
 The Mainer Electric Co., Ltd., 61 Albert St., Winnipeg, Man.
 John Starr, Son & Company, Ltd., Halifax, N. S.



Some Users of the Synchron

London County Councils Tramways, England.
 City of London Electric Light Company, England.
 Great Western Railway Company, England.
 Manchester Corporation, England.
 Birmingham Corporation, England.
 Newcastle-on-Tyne Corporation, England.
 Mersey Docks and Harbour Board, England.
 Manchester Ship Canal, England.

Chapman & Walker,
 69 Victoria St., TORONTO

Sole Canadian Agents

Our representative will gladly call and show the apparatus to responsible parties who are interested.

Where's the Doctor?

The helpless cry of helpless people when an accident occurs.

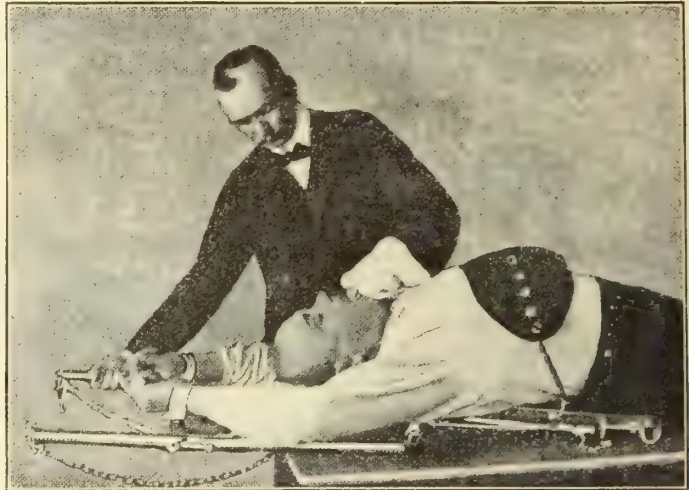
It is impossible to calculate the number of people that have died from suspended animation due to electric shock, drowning or gas poisoning.

They might have been saved had a doctor been near to restore respiration. They would have been saved had a SYNCHRON been used.

The SYNCHRON has restored animation after doctors and experts have failed. It is simple and inexpensive—any one can use it without previous practice.

Let the SYNCHRON keep the lives of your workmen from danger and your money from damage suits.

It is the only reliable automatic rescue apparatus.



V. I. R. Cables

Wire, Flexible

Paper Insulated
 Lead Covered
 Cables

Telephone Cables

MONTREAL AGENTS:

Alexander Macpherson & Son,
 Montreal, Que.



.075 sq. in. three core, circular
 lead covered, steel tape
 armoured cable

Vulcanized Bitumen Cables

Transmission
 Lines

Trailing Cables

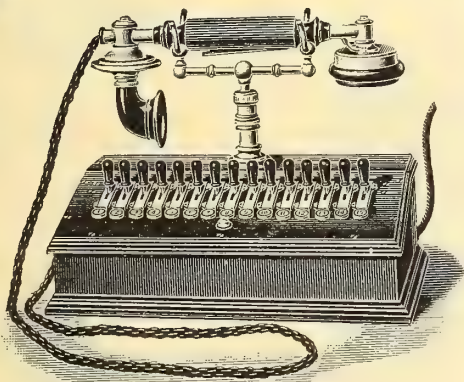
TORONTO AGENTS:

Chapman & Walker, Limited
 69 Victoria Street
 Toronto, Ont.

W. T. Henley's Telegraph Works Co.
 Limited

Contracts taken for complete Cable Systems installed

STERLING AUTOMATIC INTERPHONES



No. C 460

Perminax Interphone Systems

All Local Batteries Dispensed with

Booklet No. 173

AGENTS (with stock)

MANITOBA:—

The James Stuart Elec.
Co., Ltd., Winnipeg.

ONTARIO:—

Chapman & Walker, Ltd.,
Toronto.

SASKATCHEWAN:—

Northwestern Electric Ltd.
Regina.

BRITISH COLUMBIA:—

Cope & Son, Vancouver.

ALBERTA:—

General Supplies Ltd., 1233
2nd Street East, Calgary.

QUEBEC:—

Stocks kept by:—

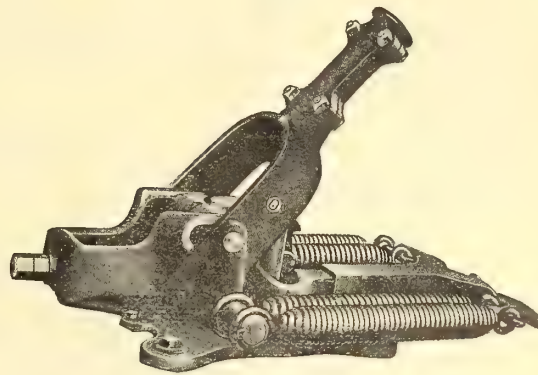
Dawson & Co. Ltd., Montreal
Mechanics Supply Co.,
St. Paul, Quebec, (Que.)

NOVASCOTIA:—

Stocks kept by:—

J. Starr, Son & Co., Ltd.,
Halifax.

This Base Is Making Good



O-B Trolley Base

Numerous service trials on City
and Interurban Roads have shown
conclusively that this Base—

1. Will positively keep wheel on the wire.
2. Will maintain uniform tension at all positions.
3. Will not cause excessive wear on wheels or overhead.
4. Will not wear out rapidly or require frequent oiling.

Convince Yourself

Get a base—look it over—you are certain to be pleased with its many exclusive advantages.

Ask us for statement from prominent roads who use it.

If the device does not look good to you, send it back at our expense.

You have everything to gain—nothing to lose.

See description on pages 388-389 of
Catalog No. 12

The Ohio Brass Co.
Mansfield, Ohio, U. S. A.



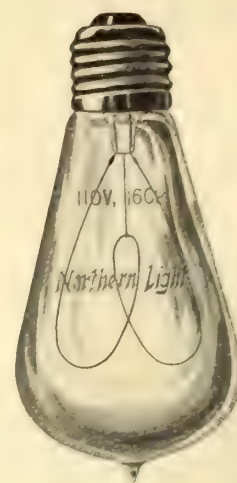
110 v. 16 c.p. Carbon Lamp
—Bulb Type

Announcing *Northern Lights*

Incandescent Lamps of Quality

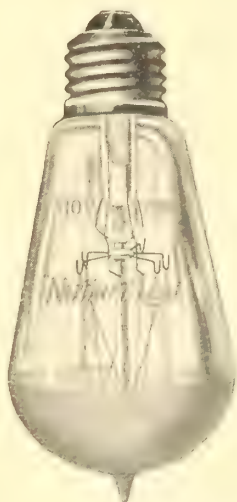
We are placing on the market a complete line of incandescent lamps under the trade name of

Northern Light



110 v. 16 c.p. Carbon Lamp—Pear Shape

These lamps are manufactured under our own specifications and are subjected to the most rigid tests before leaving the factory. Each lamp must measure up to standards of voltage, wattage, and watts consumption.



110 v. 25 w. Tungsten Filament

Northern Lights are made with
Tungsten Filament
Carbon Filament
Metalized Carbon Filament

They can be furnished in regular **Pear Shape**, **Round Bulb**, and **Tubular**, with **Standard Edison**, **Candelabra** or **Miniature Base**.

For the protection of the purchaser each lamp has the words *Northern Light* as well as the candle power and voltage etched on each bulb.



110 v. 25 w. Tungsten Filament Lamp

GUARANTEE

We guarantee each lamp for **voltage, candle power, efficiency and life**, and will replace any lamp which proves defective either in quality or workmanship.

Write Dept. 2037 for full particulars and prices.



THE *Northern Electric*
AND MANUFACTURING CO. LIMITED

Manufacturers and Distributors of Telephone Apparatus, Electrical Supplies and Fire Alarm Apparatus for every possible need



MONTREAL HALIFAX TORONTO WINNIPEG REGINA CALGARY EDMONTON VANCOUVER

Important Notice

To the Electrical and Gas Industry of Canada

Made
in
Canada



Made
in
Canada

Luceo Ball Globe 5 Sizes

All interested in illuminating glassware, will be glad to learn that our new and modern glass factory is now in full operation and prepared to furnish new, original and artistic lighting glassware of all types. Our output is solely for **Canadian** trade, manufactured in **Canada** and by Canadian labour. We sincerely trust that freedom from vexatious delays and expensive transportation involving tariff charges, breakage and other elements of cost will be taken into consideration and result in our being favored with all the business the Canadian trade can give to a home industry. Quality and prompt service is assured.

The famous **Luceo** and **Moonstone** Glass will be produced by this factory in many staple and artistic designs.

The Jefferson Glass Company
Limited

TORONTO



CANADA

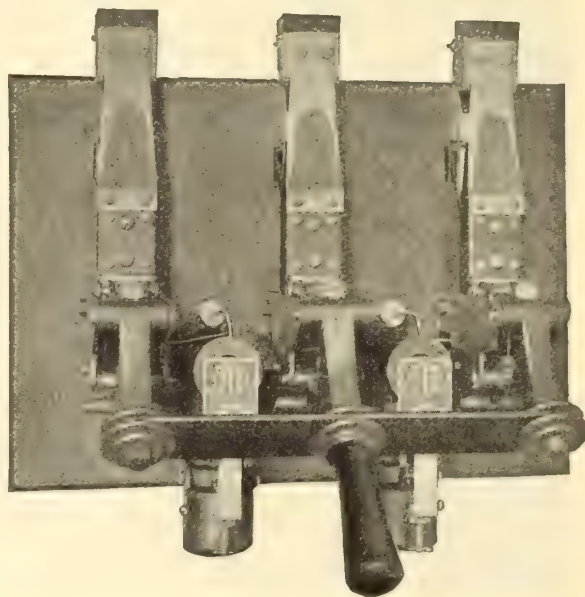


The Induction Motor



is a sturdy piece of apparatus, but staunch though it is there are many exigencies of service from which it should be given such protection as can best be secured by the use of a properly chosen

I-T-E Circuit Breaker



The Type "W," three pole, Time Limit (DALITE) Circuit Breaker shown herewith is admirably adopted to the protection of induction motors operating under a wide variety of conditions. This form, together with others covering practically the entire range of industrial service, is described in our new

Hand Book of the I-T-E Circuit Breaker.

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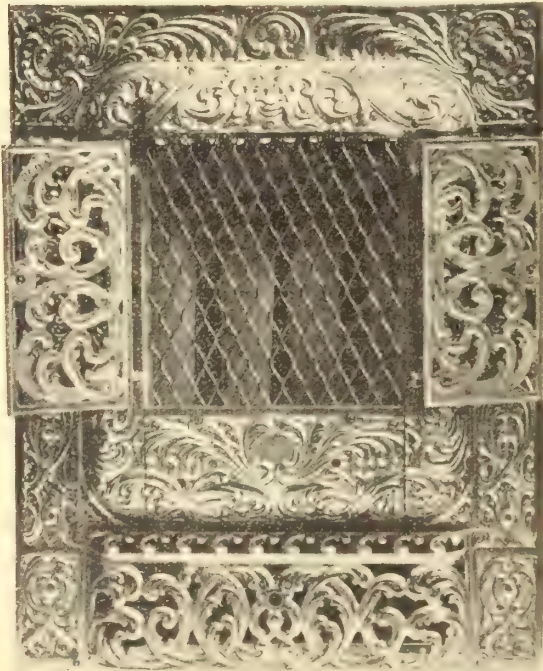
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3 Lamp Luminous Radiator furnished in oxidized copper only. Will give greater heat than any other radiator using same amount of electricity.

Oxidized Copper only \$12.00

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Has three heats—High, Medium and Low

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Anywhere that a carpet sweeper will go the "Eureka" will go.

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"Noark" Enclosed Fuses

operate as their name implies—with "no arc" or flash,—and with no noise. They are absolutely reliable in operation, automatically indicate when blown, and being "National Standard," are interchangeable.

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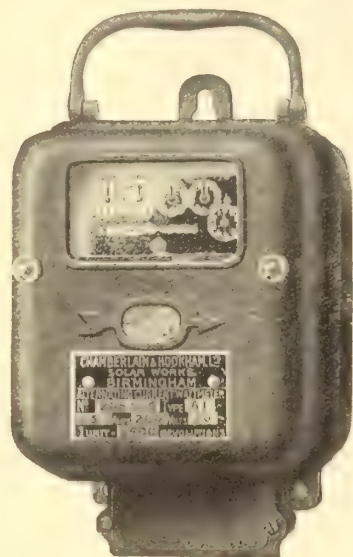
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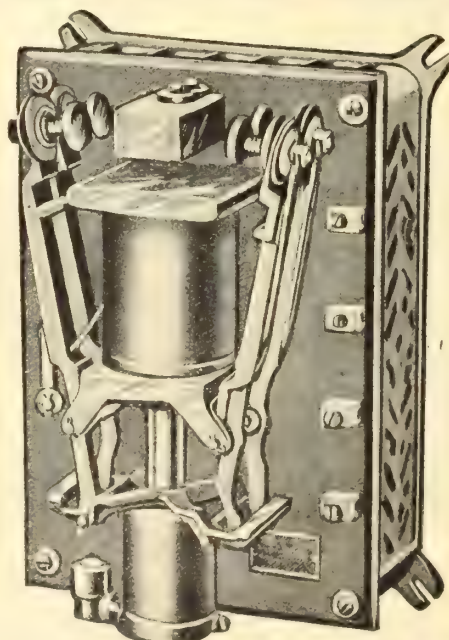
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Compact and reliable starter for Direct Current. No sliding contacts.

The advantages of this type of construction are not only simplicity and easy replacement of wearing parts, but also the elimination of sliding contacts which cause trouble due to arcing and consequent sticking of the moving member.

The construction of the Sundh Automatic Starter is compact and simple, consisting of a solenoid, a plunger with retarding dash-pot, and two or more levers hinged to the lower pole-piece of the solenoid.



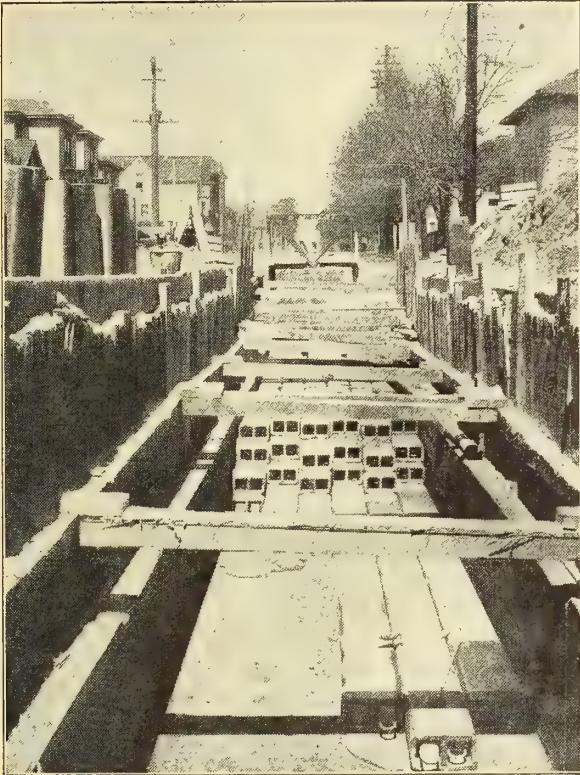
The upper ends of the levers carry the contacts. The levers are controlled by their lower ends passing through a frame which is attached to the bottom of the plunger. The contacts are of copper and carbon, and all wearing parts are accessible and easily replaced. For heavy duty the final contact is made by a laminated copper brush. This copper brush, however, does not cut out any resistance, but merely short-circuits the carbon contacts which do cut out the resistance.

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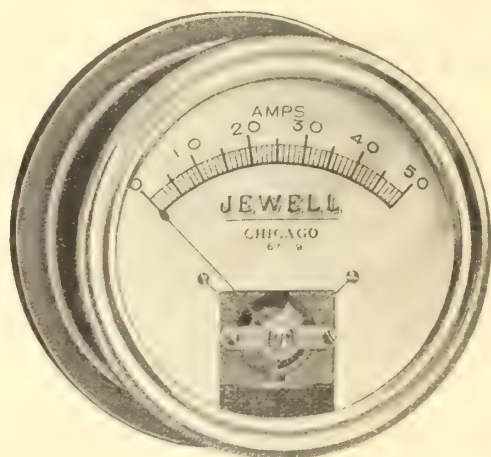
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Precision Instruments

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An Instrument for Every Purpose

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BROAD GUARANTEE

Talk No. 5

For the good of all who drop their eyes on this page, but more especially to awaken your interest (we don't care the kind of interest, be it cynical, humorous, flippant, serious, stolid, simple, or compound, so long as it isn't dead) in the MAINER ELECTRIC COMPANY, LIMITED, and in what they have to SELL.

Let's make this next Christmas an ELECTRICAL Christmas. So many electrical lines fit into the Christmas trade, that we can scarcely do them justice in this small space;—

Howard Decorative Lamp Outfits—for Xmas trees,—in eight, sixteen, and twenty-four Lamp sets,—covering snowmen, clowns, birds, beasts, fruits, nuts and vegetables,—just show a set, and see how the Public grab them up.

Emerlite Portables and Fancy Stand Lamps,—clean cut, durable, and attractive.

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If—

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most consistent
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Electrical
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P.S.—Did you get your copy of our NEW catalog yet?

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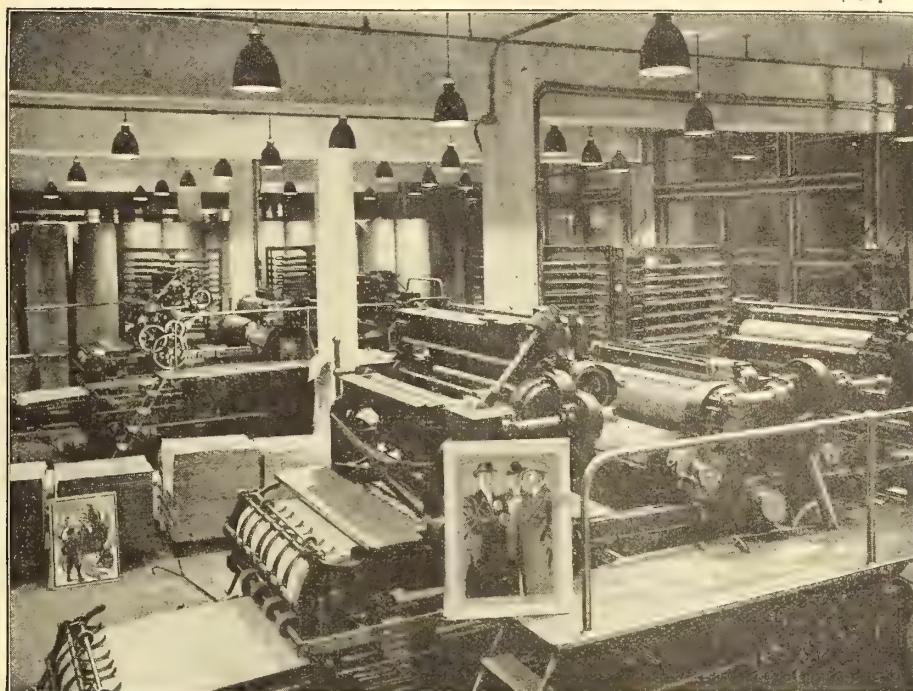
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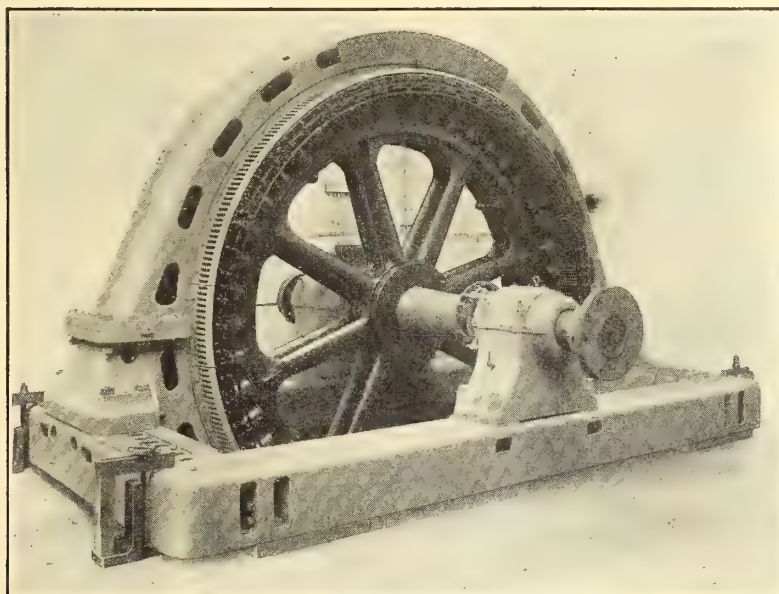


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**Complete
Equipments for
the electrical
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driving of ma-
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**Motors
of all types**

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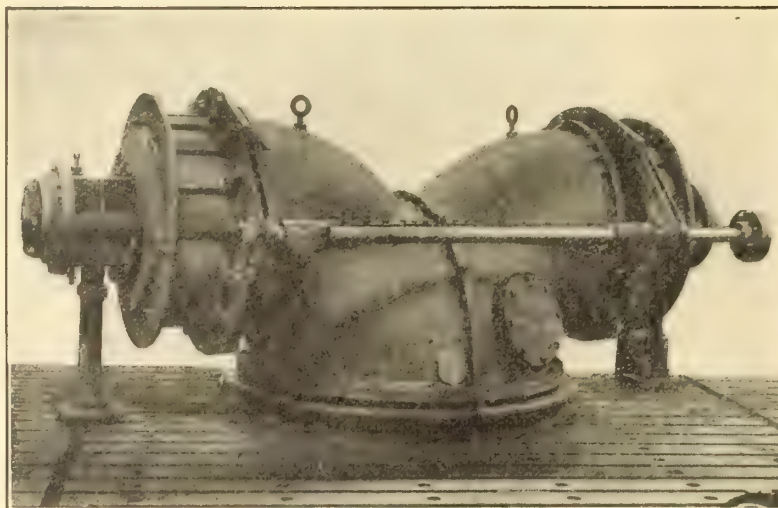
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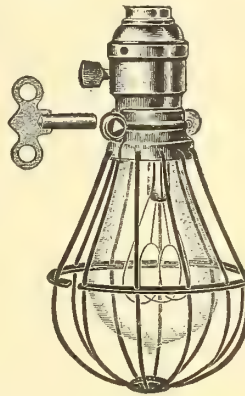
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WHY PAY TWICE TO PROTECT LAMPS?

It takes a lock to stop a thief—and it takes a guard to prevent lamp breakage. But it's not necessary to buy separate protective devices to stop these two expensive elements of waste.



LOXON
LAMP GUARD
THE KEY TO SAFETY

which locks the lamp into the socket with a key.

**Does Double Duty
at Single Cost—**

it performs the two fold function of Stopping Lamp Theft as well as Breakage and it reduces Fire Hazard.

That's why it pays the user to consider nothing but LOXONS when buying lamp protection.

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They are made exclusively by

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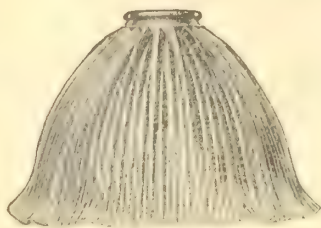
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The New
Holophane Xtraficiency Reflectors

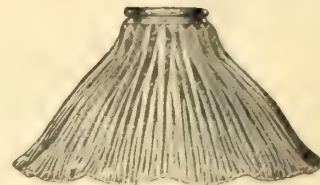
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Made for all sizes of lamps from 20 watts to 500 watts.

No change in the list prices or standard quantities. These will be shipped on all orders calling for the Standard lines.—Our factory greatly enlarged, opened Nov. 6th and is working night and day, no more delays in filling your orders.

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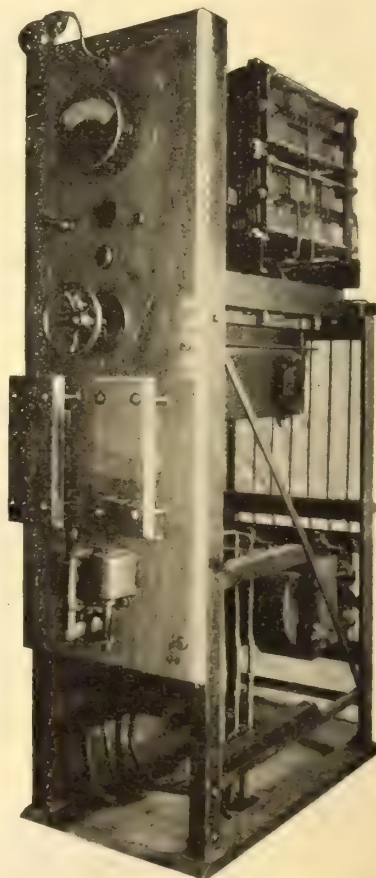
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Oil Circuit Breaker Laminated Con-
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and numerous other Electrical Appliances but space prohibits enlarging on them in this issue.

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SWITCHBOARD AND MACHINE
CONNECTIONS ARE BETTER
THAN COPPER

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Chemically pure Tungsten metal actually drawn in the form of Wire composes the Filament of **Sunbeam Drawn Wire "MAZDA" Lamps** making them as rugged as the present Carbon Lamp.

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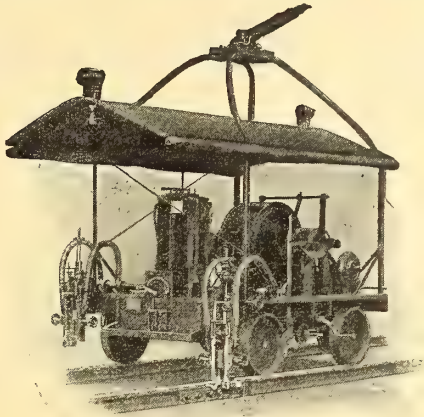
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When once installed, they are on to stay and cannot be removed without actual mutilation and considerable hard work.

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CORNITE (high-tension material), Handles for Switch-gear and heating apparatus, controller insulation, moulded parts of all kinds.

MICA and Substitutes

Japanese Paper in rolls and tapes
Insulating Pearls

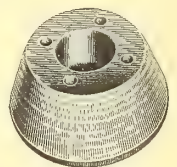
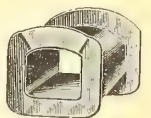
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TRADE MARK
KRAKNO
MARK



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It will pay you.

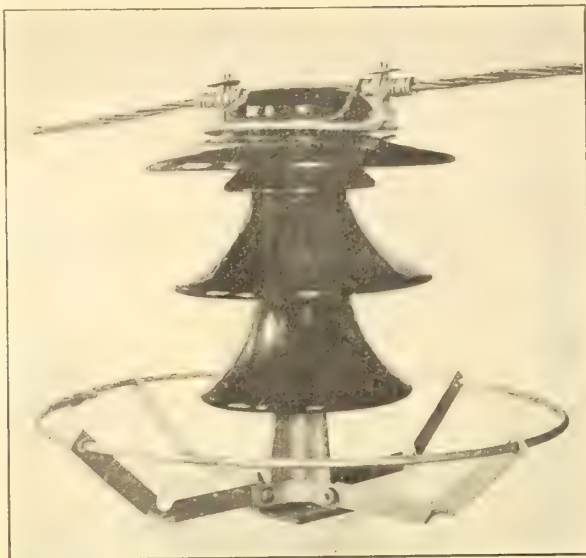
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Sand Blast No. 1

Made in Crystal, Green and Amber



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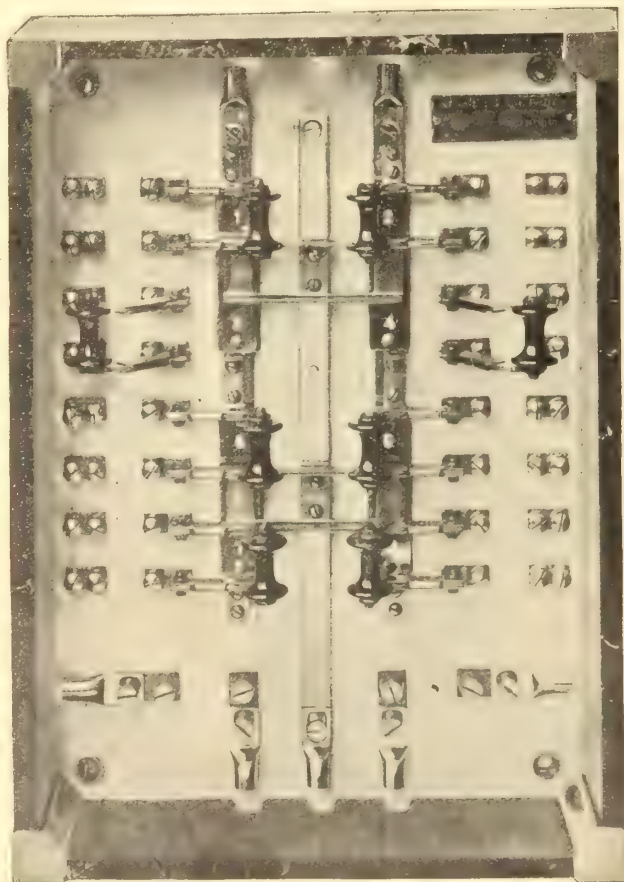
what will help your insulator troubles from lightning or other surges, this may be valuable reading, because we want you to know that Nicholson arcing rings are designed to eliminate nearly all such trouble. The better your insulators are in design and quality of material, the more interested you should be because you cannot buy insulators of anyone anywhere that are within themselves lightning proof, but equipped with arcing rings, you have practically removed your only and probably very serious line trouble.

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OR

Engineering Equipment & Supply Company

410 St. James Street,
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Switch Boards

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Panel Boards

Are the make used in many of the largest institutions, office and government buildings in the United States and Canada.

WHY?

because they are the recognized leaders.

Send us your enquiries.

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TORONTO, ONTARIO Limited

Special Notice to the Trade



¶ Our Fall catalogue has been considerably delayed owing to the many new designs which we have been making. The printer promises same will be in our hands within the next few days, and we will immediately begin distributing same.

¶ This catalogue will cover a very wide range of handsome and inexpensive fixtures, both of the direct and semi-indirect type. Included in same will be several designs using the ever popular effective candle-tick to its best advantage. Also a number of fixtures adapting crystal decorations.

¶ We have not overlooked the use of leaded glass in Dining Room Domes, Hall Lanterns and several very handsome portables.

¶ We are very anxious that all the trade, as well as those interested in the better grade of fixtures, should receive this catalogue, therefore to be sure that you get a copy send us your name and address at once.

The Tungstolier
COMPANY



of Canada, Limited

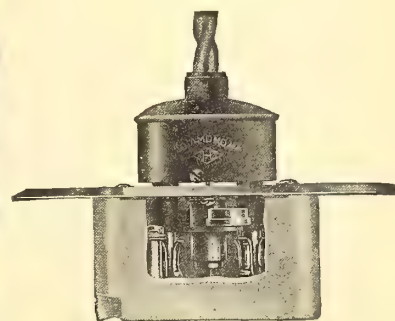
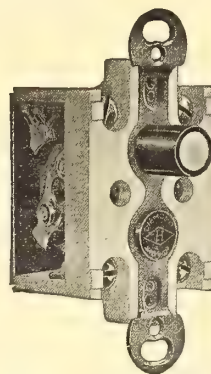
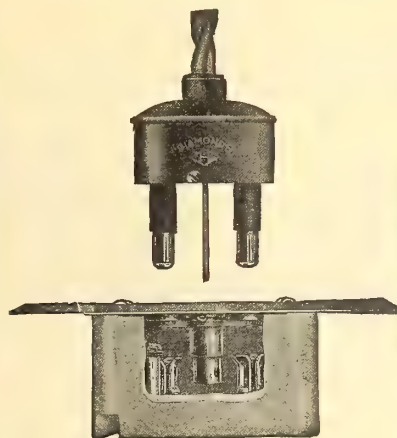
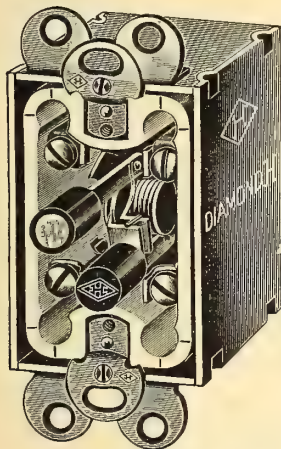
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The "Diamond H" on a switch is valuable insurance—assurance that quality, materials and competent workmanship are embodied to perfect production.

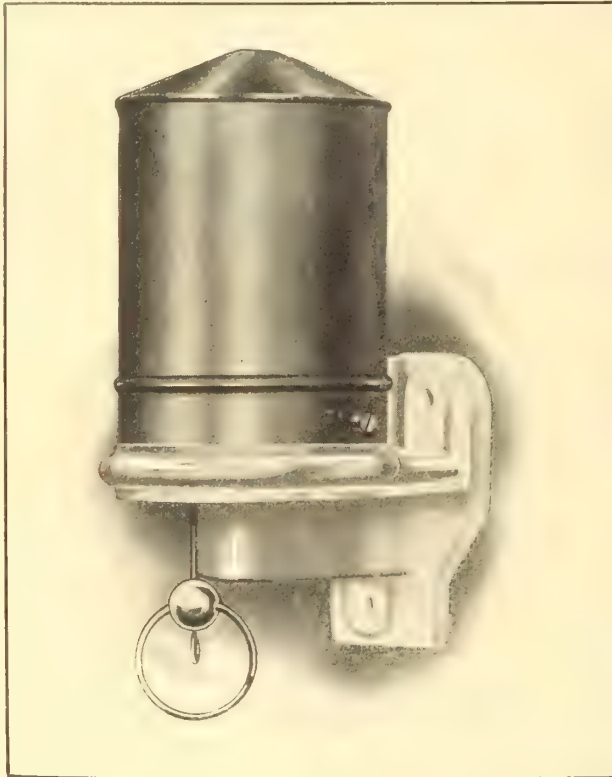


MANUFACTURED BY THE HART MANUFACTURING CO., HARTFORD, CONN.

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Flat Rate Controller



Satisfies Your
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Reduces Operat-
ing Costs

Eliminates Meter
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Smallest, Lightest
and Most Durable
on the Market

Write for illustrated pamphlet and prices

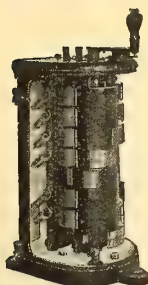
Made in All Capacities up to 5 Amperes

The Only Reliable Controller for
Tungsten Lamps

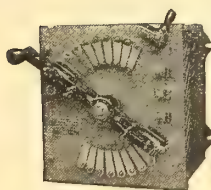
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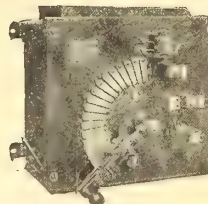
A.C. Starter, Drum Type
Bulletin 9135



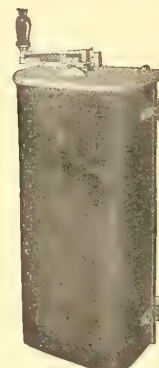
A. C. Starter for Slip
Ring Motors of Mod-
erate Capacities
Bulletin 9135



6-in Speed Regulator
for motors 1/20-1/6
H.P.
Bulletin 8520



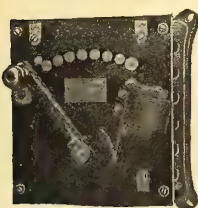
D. C. Motor Starter
Bulletin 2110



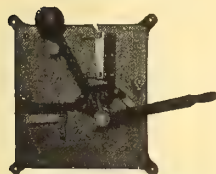
Crane Controller
ask for
Bulletin 5300



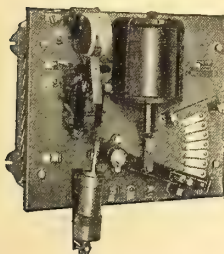
Dust Proof D. C. Motor
Starter
Bulletin 2190



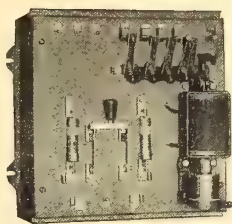
Speed Regulator for
Fans, Pumps, etc.
Bulletin 3110



Float Switch for use with
Pumping Equipments
and Self-Starters
Bulletin 6775



D.C. Self-Starter
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Automatic Motor Starter
for Pumps, Vacuum
Cleaners, etc.
Bulletin 6100



Gauge Type
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Bulletin 6760



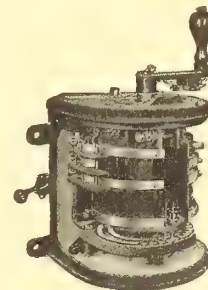
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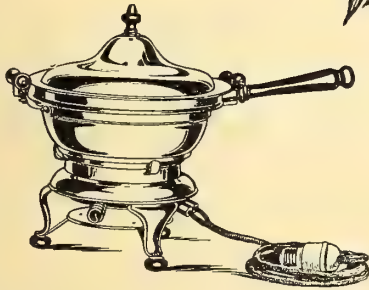
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Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Cobalt South Porcupine Winnipeg Calgary Vancouver Victoria Nelson Prince Rupert



An Electrical Christmas This Year

Electric gifts are useful gifts, each does some one thing better than it can be done any other way, whether it is to toast bread, make coffee, or run a sewing machine.

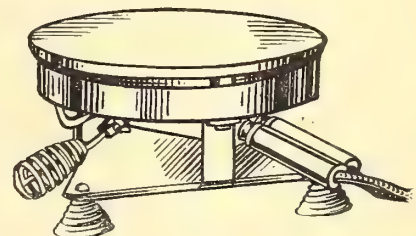
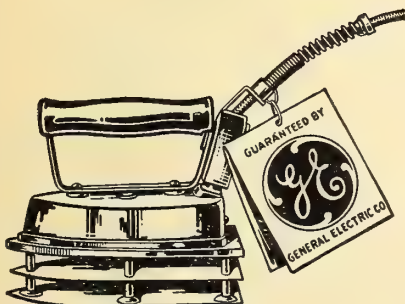
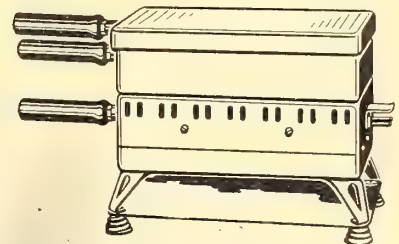
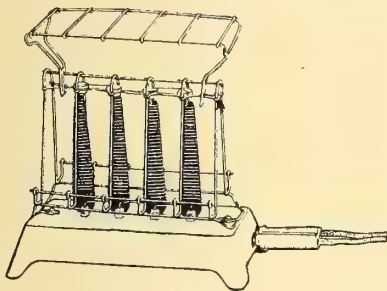
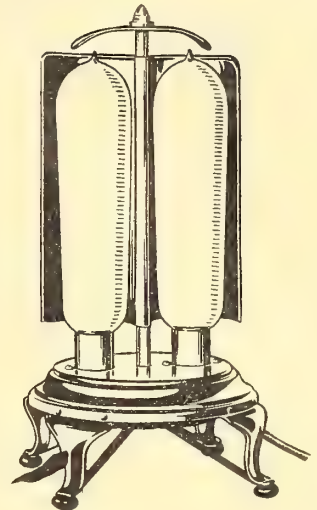
So complete is the C. G. E. line of electric Christmas gifts that in it you will be sure to find something for every member of the family.

Only C. G. E. heating devices contain the indestructible "Calorite" heating unit which transforms electricity into heat as effectively as the metal filament of the Mazda Lamp changes electricity into light.

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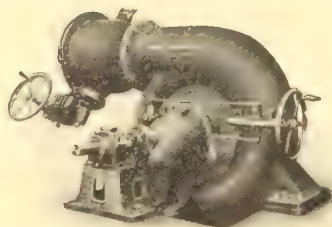
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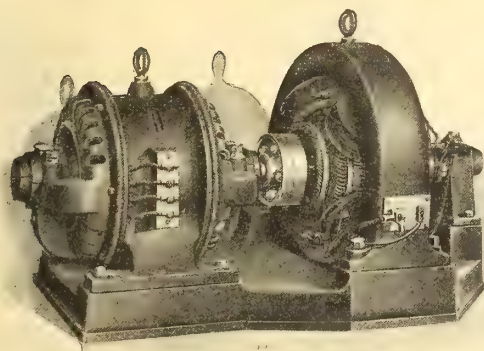
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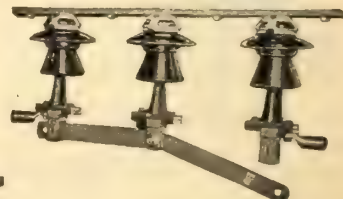
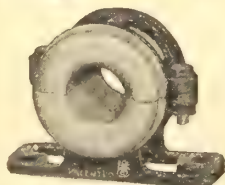
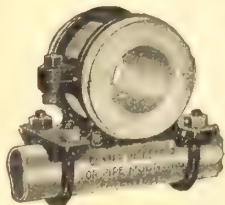
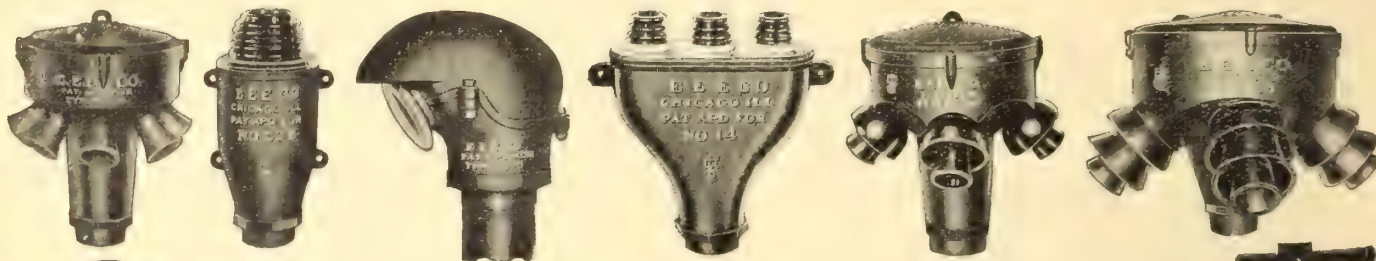
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Electrical News

Generation, Transmission and Application of Electricity

PUBLISHED MONTHLY BY

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Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Vol. 21

Toronto, December, 1912

No. 12

The Taxing of Municipal Utilities

The question as to whether a municipality owning its public utilities has power to assess and tax such utilities, has been raised in Berlin, Ont. The Berlin and Waterloo Electric Railway operates in the towns of Berlin and Waterloo and has a suburban line connecting these towns. In 1910 the question of distribution of profits was raised by the town of Waterloo, and the Ontario Railway and Municipal Board decided that one-quarter of the net income should be paid to Waterloo in return for its share of the franchise. Following this order the city of Berlin proceeded to assess and collect taxes from the system thus reducing the profits payable to Waterloo. The question is now raised by Waterloo whether a municipality has the right to tax municipally owned public utilities and the result of the discussion will be followed with great interest by other municipalities similarly situated. Recently an attempt to collect taxes from the Toronto Hydro-electric system was unsuccessful.

While the question of law involved may be a difficult one, there seems no room for hesitation in supplying the answer from a moral point of view. If the municipal undertaking does not benefit all citizens in the municipality alike, plainly a common tax is unjust and the utility should be taxed. In the present case the street railway is solely for the convenience of those who ride, and benefits, approximately speaking, only them. To tax the citizen who chooses to walk, either from financial, locality or physical reasons, is wrong in principle.

Quite recently the question of taxing the municipal electric equipment in Toronto was raised, but was hushed up for evident reasons. In that city the financial status of this municipal power undertaking is such that it not only can

not afford to pay taxes, but it has even been found necessary to increase the water rates to eke out the general deficit resulting from enormous first cost and later inefficient management. In so far as the cost of water pumping and the lighting of streets and public buildings is concerned this amounts almost to the old plan of taking money out of one pocket to put it in the other. But the operations of this municipal system extend to private house lighting, the rates for which have been reduced under keen competition with a private company until this also is operated at a loss.

This loss in private house lighting in Toronto is being made good, in part, by an increased tax on the 80,000 odd water consumers, of whom it is probably safe to say that less than ten per cent. use electric lighting in their homes. It is an ironical paradox—the poor man suffers most in maintaining a system claimed to exist for the poor man's relief.

The Proposed New Wiring Code

Keen opposition has developed to the new wiring rules recently sent out by the Hydro-electric Power Commission of Ontario. It is probably true that this opposition is the result of the feeling that the new rules are no improvement on the National Code rather than of any great objection to the rules themselves. There are different cases, however, where the new requirements are not viewed with favor, the contractors feeling that the specifications as outlined by the Hydro-electric Commission code would not be as efficient or as suitable for Canadian work as the equipment now used. We have yet to hear any real complaint against the requirements in the National Electric Code. Though we may all recognize that the rules are not perfect it is generally believed that they represent the result of the best thought and experience in electrical construction work up to the present time, and errors or omissions such as there are, being recognized as such, will be remedied as soon as conditions make this possible.

Another argument that must carry great weight against any new set of rules is that dealers and contractors would require to carry a duplicate set of equipment and installing machinery. This would mean a much greater outlay in capital scarcely justifiable by any possible good that a new set of rules would be expected to provide.

Studied from the purely theoretical point of view it does seem highly improbable that any man or small group of men can sit down and compile a set of rules equal to the result of twenty years of practical experience and application which has produced the National Code as we know it to-day.

Co-operation

Too much cannot be said in commendation of the growing tendency on the part of large electrical companies to consider the social and intellectual needs of their employees. Following the lead of a number of other Canadian companies, the B. C. E. R. Co. of Vancouver have just fitted out, at their own expense, very fine assembly and club rooms and have supplied facilities to the members for that enjoyment and recreation, both physical and mental, so necessary to the performance of good work. It is said the membership is already in the neighborhood of two hundred and fifty, and when we consider that the number of employees on this company's pay-roll is something over 5,000, we get an idea of the great possibilities to both the men and the company—and ultimately to the public—underlying the prosecution of such a philanthropic policy.

Aside from the philanthropic idea, though, it is more than possible that any company invests wisely, and reaps big dividends, from the inauguration of a scheme which tends to make the lives of its employees happier and healthier. The day is past when the employer can afford to say that he

does not care how his employees spend their time out of hours so long as they do their work. The useful employee of to-day must bring to his work a sound body and mind, an ever increasing intelligence and fund of information, and more than all a sympathy with and interest in his work, his fellow workmen and his paymasters. In what better way can this frame of mind be attained than by kindly, human treatment, clean social intercourse, interesting papers and discussions on his own and closely allied daily tasks—and the big fire place—surely the management of the B. C. E. R. were well advised in adding this significant “welcome” sign to their other thoughtful furnishings.

We see nothing but good, to all concerned, following the institution of such generous ideas, and hope the immediate future will see the general adoption of similar plans in the towns and cities throughout Canada.

“Mould conditions aright and men will grow to fit them.”

Recent Developments in Electricity

Dr. L. A. Herdt, of McGill University, was the speaker at the lunch hour talk of the Electrical Association of the Province of Quebec held in Montreal on Oct. 31. His address was on “Recent Developments in Electricity.” After a brief reference to the great utility of such gatherings, Dr. Herdt remarked that two groups of men were largely responsible for the progress of mankind—those working on fundamentals and those working on applications; men engaged in pure research and men engaged in practical work. There was practically no difference in the work of these men, and they ought to get in closer touch with one another. The work of engineers at one time dealt almost altogether with materials but it had developed from the use of materials alone to the use of materials and forces; the electrical engineer dealt almost entirely with forces—electricity being in fact, that which gave life to the work of engineers, or the active element in engineering works.

Dr. Herdt briefly passed in review the development in line potential, stating that the definition of high potential constituted in itself the history of the electric art. He outlined the evolution of line potential starting with the 100 volt line—the three wire system at 220 volt—the multiple wire system at 440 volt. The introduction of the alternating current transformer then raised the line potential to 1000 volt, 2000 volt and hence to 10,000 volt. The prediction was then made that the limit of potential was reached, but still it rose higher and higher until 50,000 volt transmission lines were used, transmitting thousands of kilowatts, and distances up to nearly 100 miles were covered. The discovery of the corona was made and it was believed that this would absorb all the energy on transmission lines, and that they could not operate on higher voltages. The speaker cited the work done on the Shawinigan transmission line, 85 miles long, some ten years ago, when special research had to be made on different types of insulators to carry this voltage, by Mr. R. D. Merzhon, the consulting engineer, now president of the American Institute of Electrical Engineers. This investigation was carried out at McGill University, with the help of the university staff. At the present day 100,000 volt lines are being built and operated without any difficulty, and the limit of line potential evidently is not yet reached. The new problems which have to be solved are due to the increased size and energy of modern electrical systems.

With regard to recent railway electrification, Dr. Herdt referred to the great work being done by the steam railways in connection with their terminals and tunnel services. The use of electricity in some branches of steam railway services was made compulsory, as steam locomotives had limitations, and had been found unsuitable and inadequate

for tunnel and terminal service. The natural development of railway electrification would be the extension of these zones. The great difficulty at the present time was the selection of an electrical system which would apply to all the different services in railway engineering. The electrification of railway lines would extend and become universal, but electrical men had to consider at the present moment its application to local necessities, and not a general demand for the improvement of the railway service.

On the question of the development of illuminants, Dr. Herdt stated that the old carbon filament lamp had given way before the tungsten type. The efficiency of the incandescent lamp had increased from 10 lamps of 16 c.p., equivalent to one horse power, to 30 tungsten lamps of 20 c.p., and it was confidently expected that 40 of such lamps would soon be operated from the energy of one electrical horse power. Arc lighting had been completely revolutionized. The old d.c. current arc lamp had been replaced, first by the enclosed a.c. arc lamp, and then by the various forms of luminous or flame arcs and magnetite lamp. At the present day the energy for all electrical services, motors, electric lighting, heating, &c., is obtained from one system of supply mains generated in huge electrical stations that are built in order to produce electricity cheaply.

Reorganization of Photometric Commission

The International Photometric Commission, commonly known as the “Zurich Commission,” was created by the International Congress of Gas Industries which convened in Paris in 1900. This Commission, composed of representatives from the various national technical gas societies, with the co-operation of certain of the national laboratories, has been concerned with general questions of photometry in addition to its more specific functions in connection with the photometry of the incandescent mantle. Inasmuch as there has developed a widespread appreciation of the need of an international, thoroughly representative commission to deal with general questions of photometry, and possibly also of illumination, it has been proposed that the International Photometric Commission be reorganized to fulfill these requirements in a way acceptable to all photometric interests. This movement is being well received both in Europe and America. President Vautier of the International Photometric Commission, has requested the sub-Commission on Photometric Units and Standards to formulate a plan of reorganization. This Sub-Commission was originally appointed at the 1911 session of the International Photometric Commission to consider the recommendations of the Illuminating Engineering Society (U. S.) regarding photometric nomenclature and standards. The Sub-Commission at present is composed of the following members: Dr. Brodhun, Dr. Kusminsky, M. F. Laporte, Mr. C. C. Paterson, secretary. M. Th. Vautier, ex-officio, and a representative of the United States soon to be appointed. The personnel of the Sub-Commission, composed of representatives of the various national laboratories, is peculiarly qualified to undertake the duty of formulating plans of reorganization. It is hoped that as the outcome of the efforts of the Sub-Commission an essentially new commission will be formed which will be equally representative of and responsible to all national technical gas, electric and illuminating engineering societies, and other bodies interested in photometry and illumination.

It is proposed to install the telephone system of train despatching on the main line of the Grand Trunk from Montreal to Chicago. The system is also to be put into force on other portions of the company's lines, and will be in use at the beginning of the year between Toronto and Sarnia tunnel.

A n n o u n c e m e n t

¶ Commencing January, 1913, the Electrical News will be issued semi-monthly, instead of monthly as heretofore. The dates of issue will be the first and fifteenth of each month.

¶ In view of the rapid progress of recent years in the development of electricity throughout Canada, and the wider field of application, we believe the time has arrived when the Electrical News, as the exponent of that important industry, should be issued more frequently than once a month.

¶ Efficiency in service to the subscriber can be attained only through a careful study of his requirements. The electrical industry of to-day is vastly different from that of even ten years ago. Important developments, involving perhaps millions of dollars, are decided in a short time; improvements designed to effect economies are continually coming to light; invention and discovery are constantly producing something new; activity is characteristic of the electrical field throughout. The electrical man of to-day, whether consulting engineer, central station manager, manufacturer, dealer or contractor, or in whatever capacity he may be engaged, depends upon the technical press for information.

¶ The Electrical News as a semi-monthly will be able to more efficiently serve its subscribers and advertisers than if continued as a monthly. This, briefly, is our reason for the change.

¶ The subscription price will hereafter be Two Dollars a year.

¶ Many evidences of appreciation of our efforts in producing a high-class technical journal have been given us. To our subscribers and advertisers we express our thanks, and anticipate an equal measure of co-operation and support in the future.

The Publishers

Interesting Cost Figures on the Sherbrooke Railway and Power Development

An unusually interesting paper was recently read before the Canadian Society of Civil Engineers, Montreal, when Mr. C. L. Cate, A.M. Can. Soc. C.E., presented a description of the hydro-electric plant of the Sherbrooke Railway and Power Co. at Sherbrooke, P.Q. This plant has already been described at length in the Electrical News but a very interesting departure was made in this case by the addition of cost data on the different sections of the construction work. These we print below in full as taken from the society's publication.

The development consists essentially of:—

(1) A concrete dam with a northern bulkhead section 225 feet long and about 20 feet high, a central overflow section 70 feet long and 44 feet high, a stop-log section 14 feet long,—used during construction to pass water for the old Street Railway Power House, and which can be used in future as an adjunct to the overflow section, should this become necessary during spring freshets,—and a southern bulkhead section 42 feet long and 12 feet high. The dam contains about 3,400 yards of concrete.

(2) A steel penstock 660 feet long and 9 feet 6 inches in diameter with a standpipe 16 feet in diameter and 56 feet high.

(3) A brick and concrete Power House 90 feet x 38 feet with hydraulic and electrical equipment for developing 3,000 h.p.

All concrete used on the work was mixed in the proportion of 1-3-5 except in beams and slabs where 1-2¼-4 was used. Suitable gravel was substituted for sand and broken stone.

The costs given are for the construction of the dam, penstock and Power House, with complete equipment. They do not cover the cost of the site and power rights, as these are of purely local interest.

About one thousand dollars expended on a bridge to one of the factories near the dam and an approximately equal amount allowed the contractor on account of certain hold-ups due to legal proceedings are also omitted.

Dam:—

Cost Data

Excavation:

Earth, 691 cubic yards at \$1.00 ...	\$ 691.00
Loose Rock, 100 cubic yards at \$1.50 ...	150.00
Solid Rock, 799 cubic yards at \$2.00 ...	1,598.00
*Solid Rock below Elevation 102. ...	3,455.00
	<hr/> \$5,894.00

Concrete, 3,430 cubic yards at \$7.75 ...	26,582.50
Steelwork ...	500.00
Stop-logs and fittings ...	900.00

Total cost of Dam ... \$33,876.50

Penstock and Standpipe:—

Excavation:

Loose Rock, 362 cubic yards at \$1.50. \$	543.00
Solid Rock, 388 cubic yards at \$4.00 ...	1,552.00
	<hr/> \$2,095.00
Concrete, 744.6 cu. yds. at \$9.00 ...	\$6,701.40
*Concrete, 200 cubic yds. at \$8.50 ..	1,700.00
	<hr/> 8,401.40
Reinforcing steel, 1,000 lbs. at 4 cents	40.00
Permanent Protecting Cribs, etc. ...	625.00

* The preliminary plans on which the contract was signed showed rock bottom at Dam at El. 102. As mentioned in the description of the work, bottom was found to be some 20 feet lower. This lower excavation was done by the contractor on force account plus 15%.

† The standpipe foundation was constructed at the Power House foundation unit price of \$8.50 per cubic yard.

Straight Penstock, 608 feet at \$20.00 ...	12,160.00
Standpipe, elbows, thimble, etc., 125,000 lbs. at 6c. ...	7,500.00

Total cost of Penstock and Standpipe ... \$30,821.40

Power House:—

Excavation (including tail-race):

Earth, 924 cubic yards at \$1.00 ..	\$ 924.00
Solid Rock, 1,690 cu. yds. at \$1.75	2,957.50

	<hr/> \$3,881.50
Concrete, 851 cubic yards at \$8.50 ...	7,433.50
Concrete in Beams and Slabs, 107 cu. yds. at \$12	1,284.00
Reinforcing Steel, 17,200 lbs. at 4 cents ...	688.00
Brickwork, 9,065 cubic feet at 50 cents ...	4,532.50
Earthenware Copping, 216 lineal feet at 40 cents	86.40
Door ...	80.50
Windows, 748 square feet at \$1.50 ...	1,122.00
Roof lumber (laid), 16.5 M. feet B.M. at \$45.00	742.50
Roof Covering of 28 gauge galvanized iron, 55.5 squares at \$12.00 ...	666.00
Tar and gravel roof ...	32.10
Structural Steel ...	2,123.00
Crane ...	1,030.00
Painting ...	166.00

Total Cost of Power House ... \$23,868.00

Unwatering and removal of old works for the

erection of Dam, Power House and Penstock. \$	8,600.00
Hydraulic equipment, complete ...	30,640.00
Electrical equipment, complete ...	38,000.00
Extras ...	1,200.00

Total cost of construction complete ... \$167,005.90

Mr. Henry Holgate presided and the reading of the paper was followed by a short discussion. Dr. L. A. Herdt remarked upon the enormous development that had taken place in recent years in hydro-electric operations. An interesting point in the paper was the difficulties met with in controlling the water during the stages of construction. Another point was the details given of the cost of construction, materials, equipment, &c., which are very rarely given out by engineers. The details showed that the cost worked out at about \$75 per kilowatt, which included construction, equipment, etc. Messrs. Thornton, de Gaspé Beaubien, Dietrich, and Prof. McLeod also briefly spoke, emphasis being laid on the publication of the costs.

Hamilton Wants Wires Underground

The city of Hamilton has applied for an order directing the Dominion Power and Transmission Co. to remove their poles, wires and cables from certain streets and place them underground. This constitutes practically a test case which will govern similar circumstances in other cities and towns throughout Ontario. If the Dominion Power and Transmission Co. place their wires underground so also will the telephone and telegraph companies, and the question of deciding whether these companies will require to be compensated and of apportioning the cost of installation, the rentals, &c., involves most serious consideration. The matter is under consideration by the Dominion Railway Board acting with the Hydro-electric Power Commission of Ontario. In the meantime, it is understood, the work of installation will go ahead, the matter of costs being decided later.

New Electrically Driven Pump at Robert Simpson Company's Store, Toronto

The Robert Simpson Company of Toronto, have recently installed a special pumping equipment in connection with their hydraulic elevators, which has some interesting points. The set consists of a Siemens direct-current 275 h.p., 250 volt, 1475 to 1100 r.p.m. variable speed motor. The pump is of the Escher Wyss two stage type, designed for raising 1500 Imperial gallons per minute against a total head of 415 feet. The set pumps into an accumulator, the efficiency of the pump being 76 per cent. The normal speed is 1475 r.p.m., but after a pressure of 415 feet is reached in the accumulator the set is automatically slowed down to 1100, when the pressure from the pump side drops and the check valve to the accumulator is closed, whereupon the pump runs idle.

The motor is provided with commutation poles and Siemens two-piece commutator with the brush gear supported in the middle from the bedplate. This arrangement is very satisfactory, as it is essential that there should be no vibration due to the high number of revolutions. Although the current in the motor varies from 90 to 900 amperes, when speeding up from light load to full load, the commutation is absolutely sparkless.

It is a well known fact that the small clearances between the rotary and stationary parts of centrifugal pumps will not allow same to run for any length of time without the water passing through. In order to overcome this difficulty a new kind of relief valve (Escher Wyss patent) was designed, this valve operating automatically in such a way that as soon as the check valve to the accumulator is shut off, the relief valve is gradually opened so that a small quantity of water is discharged into the discharge tank and, consequently, a continuous flow through the pump is effected. In this way damage to the internal parts of the pump and the annoying noise and vibration, when the water is passing through the pump, is avoided; further, no water is wasted. When the pressure in the accumulator drops to a predetermined amount the motor is automatically speeded up to its normal r.p.m. The speed very seldom goes down to 1100 r.p.m., which proves that the set is working efficiently, or if it does reach the low speed, the time it remains there is only a few seconds.

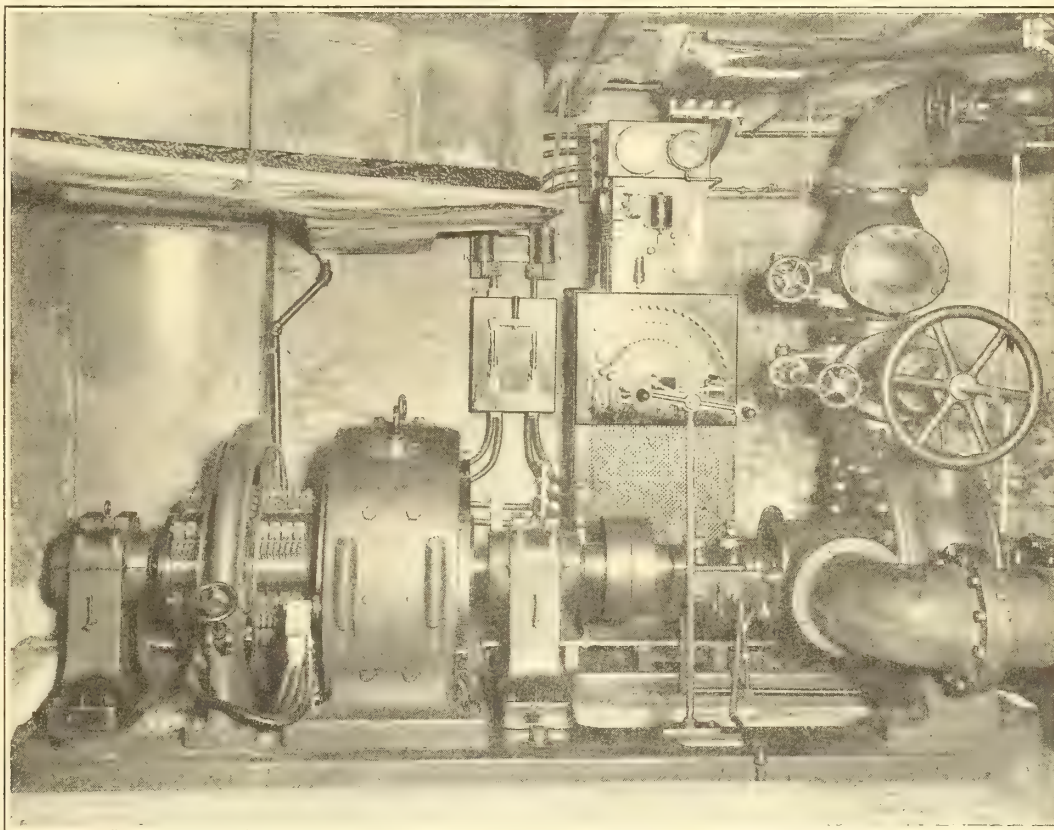
This method of pumping in conjunction with a large system of hydraulic elevators is here used, we believe, for the first time, as it is the usual practice to start and stop the set altogether. The idea is that of Mr. A. Kirkaldy, the chief engineer to the Robert Simpson Company, and all the work was carried out under his supervision.

Among the various advantages gained by this scheme

of pumping is that fairly steady pressure is obtained and the pump generally works at its full capacity, and consequently at high efficiency. The output in gallons is a little below that required when the elevators are all working so that in between times when they are not all working the pump has time to again build up the pressure within the prescribed limits. A further feature is that saving is effected inasmuch as the motor is not always starting and stopping, but is only slowed down slightly, depending upon the pressure in the accumulator. The area occupied by the set is very small, as it takes up only about one-sixth of the space required by the usual plunger pumps. The accompanying cut shows the complete pumping outfit as it is installed.

Light, Its Use and Misuse

The Illuminating Engineering Society has just issued a primer entitled, "Light, Its Use and Misuse," which is written especially for the general public. The test sets forth



Pumping Equipment in connection with large departmental store—Toronto

in a clear manner some of the general principles of illumination. The illustrations are especially good and present comparative concrete examples on the use and misuse of light. It is believed that this book will direct attention to the numerous evils attending all lighting, such as economic losses, injury to the eyes, accidents, etc., as well as create a desire for better illumination in the home, office, store, the mill, and the factory. Incidentally the primer is printed on a dull finish paper so that the pages are practically free from glare, and may be read with comfort.

An important patent suit, commenced by the Canadian General Electric Company against the Canadian Tungsten Lamp Company, has been withdrawn from the courts, the Canadian Tungsten Lamp Company having arrived at a settlement with the Canadian General Electric Company, and secured from that company a license to manufacture and sell drawn wire tungsten lamps.

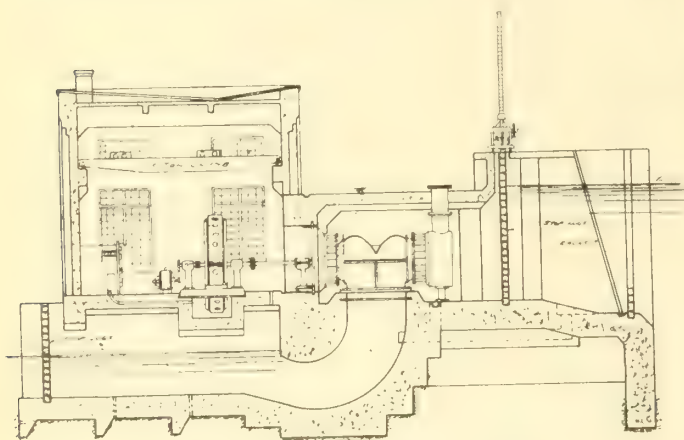
Modern Municipal Hydro-electric Development at the Town of Magog, Quebec

By A. C. Dogherty

The town of Magog, Que., inaugurated in January 1912 its hydro-electric plant which supplies energy for its water-works and electric light system, and also to the cotton mill of the Dominion Textile Company. The power is generated on the Magog River about two miles below the town of Magog. A concrete and earth dam has been built across the river at this point to form a 20 foot head.

Dam:—The concrete dam 144 feet long, 35 feet high and 45 ft. wide at base, has 6 stop-log sections 14 ft. x 15 ft. and two blind sections, and is built with tumble bays to break the force of the falling water. The stop-logs are forced into place and removed by a travelling, hand-operated stop-log winch which travels on rails built into the top of the dam. This winch operates the entire 6 bays in the dam, and the three bays in the power house. The earth dams, which are built with concrete core walls, are 10 feet wide at the top, with 2:1 slopes.

Power house.—The entire power house, including the draft tubes, is built of reinforced concrete. The structure is 70 feet long by 29 feet wide, and comprises 3 turbine



Plan of generating station—Magog

chambers and generator room. An excellent finish has been secured on the concrete work, the general effect being good, and the large number of windows provide excellent lighting. Two sets of stop-logs are provided in the gate chamber to allow the racks to be repaired or cleaned out. The power house is built for three units, two of which are at present installed. A 15 ton crane travels the length of the generating room. Fig. 1 shows a cross-section through the power house.

Hydraulic equipment.—The present installation consists of two Escher Wyss water wheels of the twin horizontal type, each of a rated capacity of 850 h.p. at a speed of 150 r.p.m. under an effective head of 20 feet, with a guaranteed full load efficiency at full gate opening of 81 per cent. The turbine gates are of the wicket type, controlled by Escher Wyss governors. The regulation is 3 per cent. variation in speed on 25 per cent. change of loads and 15 per cent. on a 100 per cent. change on the basis of a fly wheel effect of 225,000 lbs. ft.

Electrical equipment.—This part of the installation has been designed to conform with the best modern practice. The generators are each of 500 kw. capacity and generate at 2400 volts, 60 cycles, 2 phase, having full load efficiency of 94.7 per cent. at 100 per cent. power-factor and a regulation of 8 degrees from no load to full load, temperature rise of 35 degrees C. for 24 hours run at full load. With a 25 per cent. overload the temperature rise will not

exceed 50 degrees C. The outside diameter of the stator is 14 feet and the total weight of the generator is 50,000 lbs. The two exciters are shunt wound, each of 50 kw. capacity at 125 volts, 650 r.p.m. and are driven from the shaft of the generator by a silent chain drive. Either exciter is



View of forebay and power house—Magog

capable of exciting both generators. The switchboard consists of 6 panels of Marine finished slate, and is equipped with instruments and protective devices of the most modern type to guarantee against break down and to insure a constant and reliable service.

There is one panel for each of the generators, one for the two exciters and two feeder panels. The generators are connected through double throw oil switches to either of 2 sets of busbars. The exciters are also connected to duplicate busbars so that the generators can take current from either exciter.

The cables from the generators and exciters are run through the floor in fibre conduits to the switchboard. The



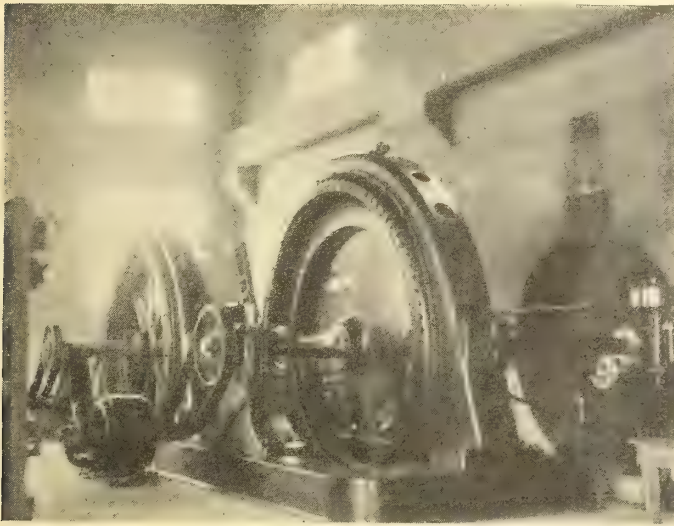
Dam and power house, discharge side—Magog

out-going cables are run along the wall in conduit and are protected by Garton-Daniels lightning arresters.

Transmission line.—The current is transmitted at 2400 volts and the line is carried on 35 foot cedar poles spaced 125 feet apart. There are three 2 phase circuits of

No. 0000 B & S, bare aluminium wire, on 3 cross arms, the wires being spaced 21 inches apart. Two of these circuits supply the Dominion Textile Co., the other going direct to the receiving station at Magog, a distance of about 2 miles.

The plant was designed and supervised by T. Pringle & Son, Limited, consulting engineers, Montreal. The power house and dam were built by the Bishop Construction Com-



Interior generating station—Magog

pany. The complete electrical equipment was supplied and erected by the Swedish General Electric Company, the transmission line by the Electric Repair & Contracting Company of Sherbrooke, the hydraulic equipment by Escher, Wyss & Company, Zurich, Switzerland, and the stop-log winch by the Victoria Foundry Company, Ottawa.

St. Catharines

The demand for power has increased at such a rapid rate during the past year that the generating equipment is being over-loaded and it is now proposed to install immediately, a generator of 1500 kw. capacity. It is also proposed to build a new power house at a cost of in the neighborhood of \$200,000. The generating equipment, the new building and all the necessary accessories will cost approximately \$400,000.

Dinner and Rejuvenation

Reference to the Electrical Dinner and Sons of Jove rejuvenation which took place at McConkey's, Toronto, on October 11th, was inadvertently omitted from our November issue. About one hundred persons were present, the large attendance being the result in no small part of the unceasing efforts of Mr. George C. Rough. An adept chairman was found in Mr. C. A. Howe. The speaker of the evening was Mr. Monro Grier, K.C., vice-president of the Canadian Niagara Power Company, who dwelt in most interesting fashion upon the great advantages of electrical development, the possibilities of the future, and the benefits which electrical men could derive from meeting together socially on occasions of this kind. Among the other speakers were Mr. R. B. Hamilton, general manager of the Packard Electric Company, and Mr. G. R. Sweeney, manager of the Toronto Hydro-electric System. The dinner concluded early, and was followed by a rejuvenation of the Sons of Jove, at which some forty candidates were initiated into the mysteries. Elaborate preparations had been made, and the scenic effects were very beautiful, reflecting much credit on those in charge.

Personals

Mr. G. A. Howe recently delivered an address before the Ottawa Board of Trade and dealt with some of the scientific points in modern illumination.

Mr. C. H. Blumenauer was recently in Toronto in connection with the opening of the Canadian factory of the Jefferson Glass Co., Ltd. of which he is president.

Mr. D. M. McIntyre, K.C., of Kingston, has been appointed chairman of the Ontario Railway and Municipal Board to succeed the Hon. James Leitch, who was recently appointed to the High Court bench.

Mr. A. G. Graves, Commissioner of Utilities, Calgary, Alta., has just returned from England and the continent where he has made a study of methods and conditions surrounding the operation of municipal utilities.

Mr. Thomas Burns, until recently connected with the Ontario Hydro-electric Power Commission, is at present consulting with the Prince Rupert Hydro-electric Company in regard to the construction of its plant at that point.

Mr. H. P. Rust, an honor graduate in the faculty of Applied Science in the University of Toronto, and son of C. H. Rust, formerly city engineer of Toronto, has been appointed to an important position on the staff of the Great Western Power Company of San Francisco.

Mr. Stanley L. B. Lines, Canadian manager of the Chamberlain & Hookham Meter Company, Limited, Toronto, has recently returned from a trip to Europe in connection with the business of the company, returning part of the way by the "Royal George"—and part on the ferry boat "North."

Mr. C. A. Dunham has been appointed signal engineer of the Grand Trunk railway. This appointment follows on the decision of the company to extend the block signal system, which is now being installed on some sections of the line. All work in connection with the installation and maintenance of block signals will be under Mr. Dunham's charge. Mr. Dunham, who was born in Hamilton, Ont., has had a wide experience with various systems of block signalling in the United States.

Mr. Parker H. Kemble, general sales manager of the Toronto Electric Light Company, has been appointed Jovian Statesman for Ontario. Mr. Kemble was recently elected first vice-president of the Canadian Electrical Association, to succeed Mr. Bird, who became president on the removal of Mr. Pack to the United States. Since coming to Canada Mr. Kemble has taken a deep interest not only in the Canadian Electrical Association, but also in the Toronto branch of the American Institute of Electrical Engineers, the Canadian Society of Civil Engineers, and many other organizations with which he is identified.

Toronto Section A.I.E.E.

The monthly meeting of the Toronto Section of the A.I.E.E. was held in the Engineers Club on the evening of Friday, November 8th, Mr. F. A. Gaby, chairman of the Toronto Section, presiding. The program consisted of the reading of a paper on "Some things engineers should know concerning the rudiments of corporate finance," a lecture originally delivered by Mr. Ralph D. Mershon and printed for private circulation by the National Electric Light Association. An interesting discussion followed the reading of this paper.

The Modern Home is the Electric Home

Private Generating Plant, Grounds Lighted, Intercommunicating Telephones, Electrically Operated Clocks, Electric Stoves Only, Motors for all Purposes

No single factor in our modern civilization lends itself so readily and so thoroughly, at the same time, to utilitarianism and luxury as electrical equipment. This is being evidenced more and more in the homes of all classes of our citizens but is probably nowhere better exemplified than in the magnificent new residence of Mr. J. C. Eaton, the merchant-prince of Toronto. Mr. Eaton's residence is situated just north of Davenport road on an estate of some 20 acres. A private power-house has been constructed and equipped as an auxiliary to the city service and in the utilization of the electric current, advantage has been taken of every practicable application of this form of energy to the various kinds of work incident to the operation of such a large estate.

The electric current for lighting and power is furnished by the Toronto hydro-electric system, at 2200 volts, 3 phase, 25 cycle, from their pole line on Spadina road, and is carried underground to the power house. It is here stepped down to 220 volts for power and 110 volts for lighting and cooking, by means of 4 Westinghouse, 50 kw. transformers. There is also installed in the power house, as a standby, a 50 kw. Westinghouse 220 volt, 3 phase generator, direct driven by a Westinghouse gas engine. A brief summary of the power-house equipment is as follows:—

Two 50 kw., 25 cycle, type "C" transformers, 2200 volts primary, 220 volts secondary, for the operation of the power equipment.

Two 50 kw. similar transformers, secondary 110 volts, for the lighting and cooking equipment.

Generating equipment, consisting of one 50 kw. alternating current, engine type generator, 3 phase, 25 cycle, 220 volts, and operating at 300 r.p.m. direct driven by one Westinghouse 3-cylinder gas engine, 11 in. by 12 in. The generator is of the standard Westinghouse alternating current type, and is supplied with a 6 kw. 125 volt, compound-wound, direct-current exciter, mounted on the generator shaft.

The engine is equipped with a natural gas mixing valve for use on illuminating gas, and furnished with a Lukenheimer valve and a No. 2 rotary Gould pump for operation on gasoline. The gasoline storage consists of 2 Bowser 20 barrel tanks, from which the engine may be operated for a considerable length of time, should the supply of gas fail, or should it be otherwise necessary to depend on gasoline. The engine is of the standard 11 in. by 12 in. cylinder type, and the specifications call for a consumption of not more than one-eighth of a gallon of gasoline per B.h.p. hour, at full load, and when operated on illuminating gas, 11,500 efficient B.t.u. per B.h.p. hour. Compressed air is used for starting the engine, the supply being furnished by a Gould compressor driven by a 1 h.p. Westinghouse motor, charging two large storage tanks.

It will be noted that the generator voltage in the power house is 220. This necessitated the provision of special switching on the secondary of the lighting transformers, to supply 110 volts for lighting and cooking. In this case, the secondaries of the lighting transformers are used as auto-transformers.

For the control of this equipment, there is installed a five panel switchboard made up as follows:—generator panel;

2200 volt panel; power feeder panel; lighting feeder panel; distribution panel.

Panel No. 1 is equipped with the necessary switches, volt-meters, ammeters, etc., for the control of the generator equipment.

Panel No. 2 is equipped with the high-tension switches, and an interlocking device so arranged that, if necessary, it would be possible to operate the lighting from the city current, and the power from the private plant. It also avoids any possibility of the city and private supply being thrown on the line at the same time.

Panels No. 3 and 4 are feeder panels for power and light respectively, and are equipped with the necessary switches and with integrating wattmeters.



Generating Plant for use in Emergency

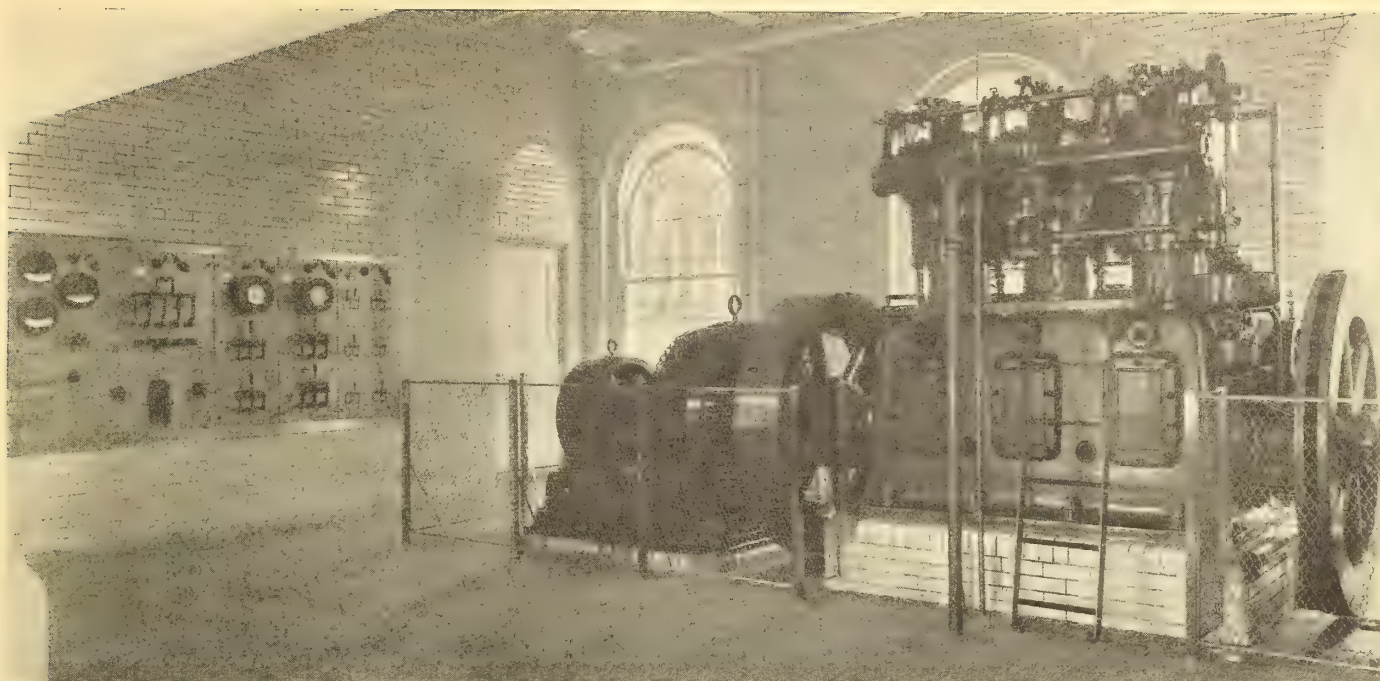
Panel No. 5 is a distributing panel for the various buildings on the grounds.

A graphic recording wattmeter (Staebler & Baker type) has also been installed.

Under normal conditions the power house is lighted from a small auto-transformer at 27½ volts, but in case of failure of the city supply, an automatic double throw switch connects with an emergency storage battery set consisting of 15 cells of Gould 300 ampere stationary type storage batteries. This assures light at all times. This set of storage batteries is charged from a small Westinghouse motor generator set.

All the above equipment is housed in the power house shown in the cut. This building harmonizes in design with the other buildings on the estate, and is constructed of buff colored Don Valley brick. The interior walls are in white enamel and the floor is of red tile. The present engine equipment is intended only for emergency purposes, as it is not sufficiently large to take care of the total load, but provision has been made for the installation of an additional unit, should it become necessary.

From the power house, the lighting and power services are carried underground to the main residence and the other buildings on the grounds. The cables for the above services, and also for the electric clock and telephone systems,



Interior Generating Station—A 50 kw. unit operated by gas-engine

were carried in standard $3\frac{1}{4}$ in. single vitrified clay conduit, in a concrete envelope. Owing to the nature of the ground, and the unusual depth to which the frost penetrates, the ducts were laid five feet below grade. The manholes and all underground work were built in accordance with standard practice.

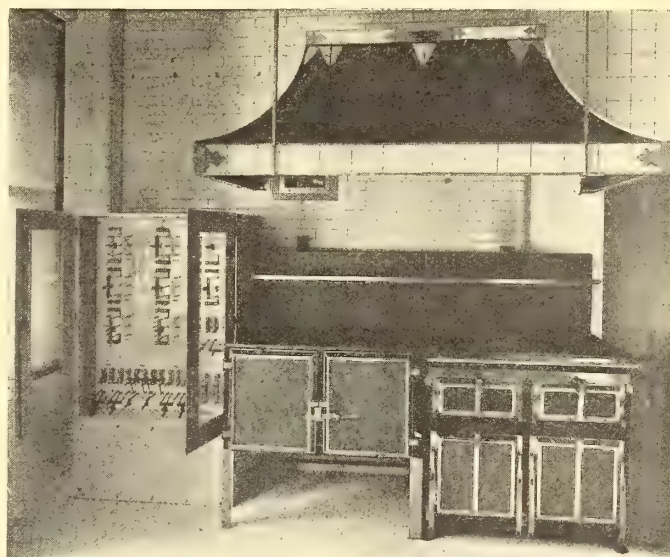
A drop of not more than 1 per cent. at full load was allowable between the power house and the various buildings, and provision also had to be made for the possibility of break down in the cables, so that the following cables were laid from the power house to main residence,—for lighting service, 3-500,000 c.m. 3-conductor cables; for cooking service, 3-500,000 c.m. 3-conductor cables; for power service, 2-425,000 c.m. 3-conductor cables. For the superintendent's residence, a 300,000 c.m. 2-conductor cable, and for the gardener's residence, a No. 3/0 B & S gauge, 2 conductor cable was used. In addition to this there are six separate circuits each consisting of two No. 8 B & S gauge, 2-conductor cable, feeding the fixtures for lighting the grounds and entrance gates. For the electric clock system, a No. 10 B & S gauge, 2-conductor cable is laid between the various buildings. The 2200 volt city service is carried underground by a No. 2 B & S gauge, 3 conductor cable, at 2200 volts.

The whole of the cables were supplied and installed by the Canadian British Insulated Company, and are of their standard 3-conductor and 2-conductor paper insulated lead covered types. Conductors are formed sector shape, thus reducing the diameter and maintaining a uniform thickness between conductors and between each conductor and the lead sheath. The entire system was tested to $2\frac{1}{2}$ times the working pressure after installation.

The lighting load in the main residence is very large, and presented some difficulties in handling. The original plan was to install eight distributing panels on the various floors. This was later changed to the one large board shown in the cut. This necessitated some increase in the size of the circuit copper, which was more than neutralized however by the advantage of having the equipment centralized. This main switchboard consists of a lighting section of two panels, an electric cooking and heating section of one panel, and a power section of one panel. The board

is a Krantz type, installed by the C. H. L. Keeler Co. Ltd., Canadian agents.

The first lighting panel has thirty-five 2-wire branch circuits, mounted on the face of the board, each equipped with a 25 ampere double pole knife switch and enclosed fuses; these circuits are accurately balanced on the various phases, in order to get equal loading. The second lighting panel is equipped entirely with branch circuit sections, each section being controlled by a "Sundh" remote control switch. These branch circuit sections take care of the lighting load



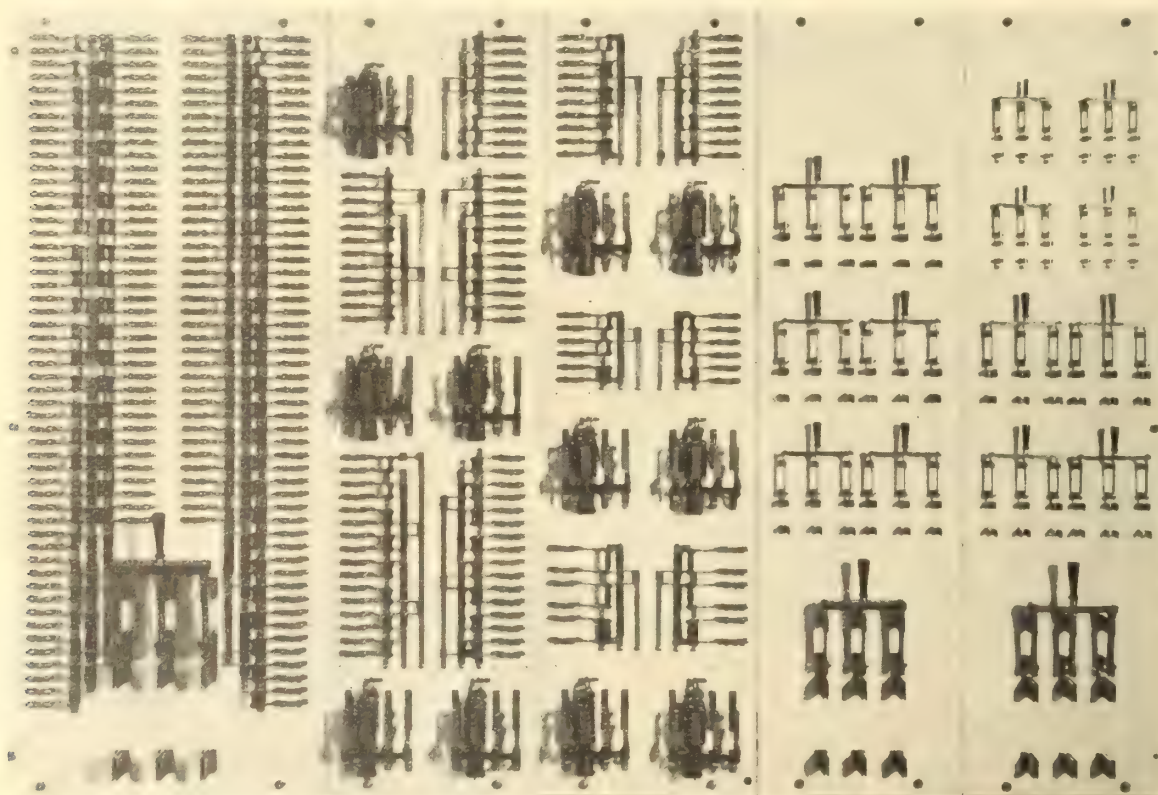
All cooking is done by electricity

of some of the large rooms and the emergency lighting circuits, and in place of the ordinary grouping of large gangs of switches, a single momentary contact push switch controls the entire lighting. The cooking and heating sections consist of the necessary number of fused 3-pole knife switches, for controlling the various units. The power section consists of six 3-pole, 60 ampere knife switches together with a main knife switch.

A unique feature of the electrical equipment of this residence is that entire dependence is placed on electric current for cooking, there being no other means of cooking in the building. A two section electric range and bake oven is installed in the kitchen, as shown in the photograph. The heating units are made of calorite metal, it being claimed that these can be used at a high temperature constantly, without oxidation, which of course injures the life of the units. Each section consists of one three-heat roasting oven, 28 in. by 18 in. by 16 in. inside measurements and consuming a maximum of 5000 watts. The heating units are assembled both at the top and the bottom of the oven, thus giving a very even temperature. Above the oven is placed a Radiant type broiler, 18 in. by 24 in., consuming 4000 watts. Above this, forming the top of the range, are provided four rectangular hot plates, each arranged for three-heat regulation, and consuming a maximum of 1750

same baking or roasting conditions can be reproduced at any time. Some pastries, which require a quick oven, are of course baked on the high heat, while at other times the ovens are operated on the lower heat. A white Italian marble controlling switchboard is supplied for the entire manipulation of the electrical cooking apparatus. There is also provided an indicating device showing which of the units are in operation.

In the serving pantry there is installed a plate warmer 5 ft. by 2 ft., constructed of heavy galvanized iron, on an angle iron frame. The walls are double, and the intervening space is filled with heat insulating material, which reduces to a minimum the energy required for heating. The units are placed on the under side of each shelf. The entire warmer is covered with polished aluminium, with nickel trimmings, which gives a very pleasing appearance. The device is arranged with a three-heat switch, having a maxi-



Panelboard and Switchboard comprising two lighting panels, one cooking panel and one power panel

watts. The two sections above described combine to form one range, constructed of heavy Russia iron, rivetted to a nickel iron frame. The ovens are double walled, the intervening space being filled with heat insulating material. This construction prevents loss of heat by radiation, and one oven or broiler can be used without the heating of the entire range. This is also true of the hot plates on top, any one of which can be heated up for use independently. The flexible control of this range is adaptable to varying requirements with a maximum efficiency under all conditions.

In addition to the above apparatus for cooking, there has been supplied a baking oven, consisting of two chambers, the size of each being 38 in. by 28 in. by 15 in. Each unit is controlled by a three-heat switch, consuming a maximum of 5,500 watts, thus bringing the oven up to heat quickly, the oven being at its maximum heat fifteen minutes after the heat has been turned on. The top and bottom units of the oven are controlled independently, and keep a very close temperature regulation, which means that exactly the

maximum consumption of 5,000 watts. A small domestic type range is also installed for use in the nursery kitchen.

The cooking equipment just described has been in continuous operation for a period of about one year, and is giving excellent satisfaction. Figures are now being prepared of the exact cost of operating the same, and at a later date will be given in suitable form.

The kitchen is also equipped with refrigerator, cooling room and freezing plant, driven by a 15 h.p. motor. This equipment is of the ammonia type, and is designed for 12-hour operation in order that it may not be necessary to operate the plant at night.

The laundry is equipped with the following direct-connected motor-driven units,—mangle, centrifugal extractor and washing machine. There is also the usual equipment of electric irons.

Other power equipment in the main residence consists of a 5 h.p. motor to drive the organ blower; a 7½ h.p. motor for the Spenser vacuum cleaner, and a 2 h.p. motor-generator set for the charging of the storage batteries. There

are also motors for the operation of the Otis push button type elevator, the ash hoist, and two dumb waiters.

The design of the lighting fixtures was given particular attention, in order that they might harmonize with the "period" or design of the room in which they are being used. The dining room and music room are lighted by the indirect method. This is accomplished by means of X-ray poke-bonnet shades, placed in the cove at the proper angle to produce a soft, evenly diffused light on the reading plane. The effect in both of these rooms is very beautiful, indeed. Special attention was given to the ordinarily considered minor details of the work. The push button switch plates were decorated in France to match the hardware, and the push switches are equipped with mother of pearl and ebony buttons in place of the ordinary composition buttons.

In each room in the residence provision has been made for the installation of an electric secondary clock to be operated by a large master clock. This master clock is wound by a small electric motor automatically, and requires very little attention. It controls a set of electrically operated



The grounds are illuminated by ornamental standards

Westminster and Whittington chimes. Two sets of storage batteries, of 10 cells each, are used for the clock system.

An intercommunicating telephone system, having a capacity of thirty-four stations, connects the various rooms in the main residence and the various buildings in the grounds.

The usual equipment of luminous radiators, and other electric utensils are in use.

A garage, having a capacity of eight cars, has been built, and is in charge of a mechanic. It is equipped with the following direct driven machinery,—a Gould & Eberhardt shaper, lathe, drill press, grinding and buffing lathe, air pump for inflating tires, and motor-generator set for charging batteries of an electric vehicle. The grounds are lighted by means of single column units, equipped with 100 watt lamps. One of these is shown herewith.

The installation of all electrical equipment on the Eaton estate was carried out under the supervision of Mr.

Geo. J. Beattie, electrical contractor, whose work has resulted throughout in a rare combination of skilful and artistic effects, combined with efficiency.

The Public Service Corporation

Mr. Fred Thomson, who has had as wide and varied experience as any electrical engineer in Montreal, gave his reminiscences at the weekly luncheon of the Electrical Association of the Province of Quebec, Montreal, on November 14. The speech was full of good things, and incidentally illustrated the difficulties of electrical engineering in the early days. Mr. Thomson went to Montreal in 1883, when he was connected with a firm which had taken from his brother the Canadian patents of the Thomson-Houston system. When the first ice palace was erected the wires had to be strung over roofs of houses, in the absence of poles. Copper wire ran out, and could not then be obtained in the city. The next installation was in St. Lawrence Hall, and, eighteen years after, the original armature of India silk was taken out in perfect condition. The Thomson-Houston Co. was taken over by Rose & Irvine as the Royal Electric Co. In the year 1884, when the British Association, headed by Lord Kelvin and other well-known scientists, visited the city, the Royal Electric Company had to do the honors. They had to light up McGill University for three nights, and it was only by running wires over citizens' front doors, trees and shutters that they managed to get the installation ready at the last moment. The establishment of connection between Montmorency Falls and Quebec, said Mr. Thomson, was at that time the longest distance work attempted in the world, and it was with the greatest difficulty that he had persuaded Abbe Laflamme, of Quebec College, that it was possible. Another thing he had managed was to run wires across the Victoria Bridge in spite of the restrictions that they were to be neither inside nor outside.

It was in 1892 that Mr. Thomson first suggested to his directors a railroad experiment in the city. They expressed incredulity and were positive that the rails would be tied up in winter, and that horses would have to come to the rescue. The following spring, however, they were eager for the experiment, and a car was obtained from the United States, which was hauled up to McGill on the horse car tracks.

The Electrical Association of the Province of Quebec adopted a new constitution at the last monthly meeting held in Montreal on November 15th. Under the new rules the monthly meetings are abolished, and the control of the affairs of the association vested in an executive committee, the members of which are reduced from 8 to 5. The general feeling was that the monthly meetings were of comparatively small value, their place having been taken by the weekly luncheons, which are largely attended and have been a great success. Mr. Crouch resigned the vice-presidency of the association, owing to prolonged absence from the city.

The Pacific Light & Power Company, of Los Angeles, have recently placed a contract for equipment to be used in connection with their 150,000 volt transmission system. The equipment includes seven 5833 kw. 150,000/6600 O.I.W.C. transformers and three 4500 kw. 150,000/15,000 O.I.W.C. transformers. The generators will consist of two 17500 kv.a., 6600 volt, 3-phase, 50 cycle, 375 r.p.m. units. The electrical equipment is being supplied by the Westinghouse Company.

**Advise us if you do not receive your
Electrical News promptly**

Montreal and Eastern Canada

Progress in Underground Work

Plans for putting wires underground on St. Catherine street, Montreal, have been submitted by the Electrical Service Commission to the Quebec Public Utilities Commission. All the companies interested have approved the plans, but it seems that when they have been passed by the Public Utilities Commission, submission of further plans, under the Act, is not allowed. Thus if it happened that such plans were needed, the work would be held up. Further, when an engineer has been appointed to supervise the carrying out of the work by contract, the duties of the Electrical Service Commission cease so far as each particular section of the work is concerned, the engineer alone having jurisdiction over the construction and maintenance of the conduit. Under these circumstances, the Public Utilities Commission have decided that further plans and suggestions should be made by the Electrical Service Commission; on these the utilities commission can act without a further hearing if the general plans are not changed, even changing them on their own responsibility. If, however, there is a change, the interested companies will be notified of a further and later submission.

The City Council are seeking authority in the Quebec Legislature to extend the power of the Electrical Service Commission by making that body solely responsible for the direction and oversight of the construction of the conduits, instead of that power being in the hands of a construction engineer.

At its maximum size the St. Catherine street conduit will be 26 inches high by 26 inches wide, the conduit being placed on both sides of the street under the sidewalks, where the cables for the power, light and street railway companies will be carried. Large manholes will be situated on both sides of the street at the intersections of the thoroughfare, while service manholes will be located at points between the large manholes, the service pipes running into buildings from the manholes. The plans provide for the large light and power cables to be placed at the bottom of the conduit, the wires for lighting and power for stores and houses being above. Arrangements have been made for street lighting, for fire alarms, and signal boxes, and the street lighting wires will be so placed that it will be possible for the city to put up a lamp at any point along the route by simply opening up the sidewalk at the point where the lamp is to stand. The Commissioners are now at work making plans for other streets.

Telephone Rates

The Bell Telephone Company have won the main point fought for in the recent inquiry before the Railway Commission, granted at the request of the Montreal City Council. The inquiry lasted three or four days, and the judgment has just been received. The city asked that the price of business telephones be reduced from \$55 to \$50 and of private houses from \$35 to \$30. This is refused on the ground that the city annexation and the developing of territory have placed such a heavy strain on the Bell Telephone Company's capital to meet demands for extensions that they are entitled to some compensations. The company's request, however, to charge these prices for the old "Blake" telephones as well as for the new ones is refused. The price will be \$5 less. The demand that in pay telephones no money should be exacted until the person desiring to

speak is placed in communication with the person desired is refused.

The Railway Commissioners decide for the city on the point of prices to be paid by part of the newly annexed municipalities on the Back River. After the New Year people in these municipalities will pay city rates for their telephones. This decision is based on the fact that Montreal West pays the ordinary city rates. Therefore Montreal West is made the basis, and outlying municipalities for a distance from the old limits of Montreal corresponding to that of Montreal West will get the city rates. This is in answer to a demand of the city that the company's tariff imposing \$5 for each additional quarter mile in Bordeaux, Ahuntsic, Longue Pointe and St. Lambert should be abolished.

Judgment in Disputes Act

Judgment has been given by Mr. Justice Lafontaine in the action brought by the Montreal Tramways Company denying the constitutionality of the Industrial Disputes Act. Many months ago a board of conciliation was appointed by the Hon. Mackenzie King to inquire into a dispute between the company and certain of their employees, and the company contended that the Federal Parliament, in passing the Act, exceeded its jurisdiction, as legislation between master and servant was confined exclusively, by the British North America Act, to the provincial authority. Mr. Justice Lafontaine has ruled against this contention, on the ground that the capital and labor problem has a wider interest than a province or locality; it is of a general nature, not of a particular or private nature in such sense that, in the terms of the B. N. A., it is to be deemed as falling within the sole jurisdiction of the provincial authorities.

Carillon Falls Development

The National Hydro-electric Company have taken another step towards supplying Montreal with power from their proposed plant at Carillon Falls, P.Q. At present a small plant is in operation, but it is planned to build a very extensive installation, which Mr. Miles, the president of the company, states will cost ten million dollars and will be capable of developing 160,000 horse power. The small plant is to be used for the building of the larger one, and also to supply the neighboring municipalities. The company have a Dominion charter, enabling business to be done in the province, and application has now been made to the Provincial Legislature to give them the right of placing poles and wires in municipalities without dealing with each one in particular. Power is sought to use the Montreal conduits for the company's transmission wires, while, pending the construction of the conduits it is asked that rights for poles and wires be granted. A clause provides for the consent of the city of Westmount being granted before making use of the city thoroughfares, but the municipality must allow a transmission line to reach other places. As to the territory the company asks to be permitted to operate in, the petition mentions Assomption, Terrebonne, Two Mountains, Jacques Cartier, Laval, Montcalm, Joliette, Berthier, Richilieu, Missisquoi, Vaudreuil, Argenteuil, Soulanges, Chambly, Chateauguay, Beauharnois, Ottawa, Iberville, St. John and Labelle. The first issue of bonds and debentures is \$12,000,000.

Quebec R. L. H. & P.

According to a despatch from Paris, the French Association of Foreign Bondholders is forming a committee of defence of the bondholders in the Quebec Railway, Light, Heat & Power Company, Limited. In a report by Mr. Gaudin, the French engineer sent out to investigate by a committee of French shareholders, it is stated that, in the event of the company being wound up at the present time, the assets would, in his estimation, be insufficient by about £400,000 to meet the debenture claims. According to M. Gaudin, the city portion of the company's property is sound and capable of producing a higher yield than is now the case, but he considers the Quebec and Saginaw Railway, the Quebec Eastern Railway, and the Lotbiniere-Megantic line as constituting a very heavy drain on the resources of the company.

Hull Electric Co.

A board of conciliation was recently appointed to settle the question of wages which had arisen between the Hull Electric Co. and its men. The board of conciliation consisted of George Wright, Hull, for the men; George D. Kelly, Ottawa, for the company, and Peter McDonald, Woodstock, the appointee of the Labor Department. The decision, which has been accepted by both parties, is as follows: 20c per hour for the first year, 21c for the second year, 22c for the third year, 23c all over 3 years. The company supplies each man with a winter uniform overcoat at half price and allows all conductors \$25 in cash and tickets.

Dorchester Electric Co.

The management of the Dorchester Electric Co. were able to keep promise with the city of Quebec and on November 1st, a new steam power plant was placed in operation though the plant is not yet complete. The turbo-generators were supplied by the Canadian General Electric Co. Mr. Wm. T. Wilson, formerly with the Montreal Light, Heat and Power Co., is general manager and has been chiefly instrumental in making it possible for his company to live up to their agreement. A number of C. G. E. arc-lamps have been installed and these, when complete, will number about 450. Ornamental standards are being used on the main streets but these are not yet in place.

The Montreal Public Service Corporation

It has been decided to reorganize the Canadian Light & Power Company and subsidiaries. Under this scheme the company will sell the power wholesale, and it will be distributed through the smaller companies—the Saraguay, Dominion Light, Heat & Power, the St. Paul, and the Central Light, Heat & Power. The concerns will be consolidated under the name of the Montreal Public Service Corporation, the capital stock of which will be five million dollars. Authority to effect these changes is being sought from the Quebec Legislature. It is hoped by means of this reorganization to effect economies in management.

10 Storey Building

Next spring the Montreal Light, Heat & Power Company will erect a ten-storey building immediately behind their present offices known as the Power Building, Craig street. Some time ago the company purchased the requisite land (facing on St. Urbain street) which is 95 ft. x 95 ft. It is also intended to add another storey to the present building, making it eight storeys. The company require additional space, and also intend to rent the remaining floors. The new building is estimated to cost \$350,000.

Northern Electric Notes

Mr. W. J. Doherty, supply sales manager, recently attended the Electrical Supply Jobbers Association convention at Hot Springs, Va.

Mr. P. F. Sise, managing director, was in Toronto recently.

Mr. H. D. Browne, purchasing agent, has returned from New York.

Mr. E. S. Estep of the Western Electric Co., Hawthorne, Ill., was a recent visitor at the Montreal office.

Mr. M. S. Allen, telephone sales manager, has been confined to his bed on account of illness. He is now on the fair road to recovery.

Miscellaneous

It has been decided by the directors of the Laval Electric Company, a subsidiary of the Shawinigan Water & Power Company which operates around St. Rose, Terrebonne, etc., to wipe out its outstanding bonded indebtedness of \$100,000 by issuing common stock for that amount at par to the bond-holders in exchange. In addition to this issue of shares, \$50,000 common stock will also be offered to the shareholders at par, bringing the company's capital up to \$310,000.

The Electric Service Company, which claims to have a plant, have asked the Montreal city council for an amendment to the by-laws to enable the company to sell and distribute electric light and power within the limits of the city, erect poles and wires, and lay conduits for these purposes. They ask a franchise for twenty-one years, the price of the light and power to be determined by the Public Utilities Commission.

The Montreal Light, Heat & Power Company are installing, at their Dominion sub-station, three 750 kw. and three 500 kw. transformers. These will concentrate the supply of power to several of the large industrial plants in the Dominion district. The transformers were purchased from the Canadian Moloney Electric Company through their Montreal office, 512 Canadian Express Building.

Mr. R. A. Ross, of Montreal, has given evidence at Buffalo before the Public Service Commission, which is inquiring into the prices charged for light and power by the Buffalo General Electric Company. The city, for whom Mr. Ross is consulting engineer, claims that the prices are too high, and Mr. Ross gave evidence suggesting means by which the company could effect large economies.

The Montreal Tramways Company, after some negotiation, have agreed to give the town of Outremont, P.Q., a car service under the terms of a contract made some years ago. By the agreement, the company will construct a single line on Bernard and Outremont streets immediately, and make it into a double line next spring.

In connection with the new power developments at the paper and pulp works of Laurentide, Limited, Grand'Mere, P.Q., the construction of the power dam will be commenced very shortly. The plans provide for the development of an additional 25,000 horse power from the Grand'Mere Falls, which it is proposed to sell.

The shareholders of the Cedars Rapids Manufacturing and Power Company, at a meeting in Montreal, authorized an increase of the capital from \$10,000,000 to \$15,000,000.

Electric Development at the Coast

The Lighting of a Great City—Vancouver Keeping pace with the brightest

By Mr. C. H. Fletcher*

Good street lighting is one of the most essential* as well as one of the most desirable features in any city, and one in which every mayor, alderman and engineer takes an active interest, and as a rule every electrician keeps himself on the qui vive to bring his street lighting system as near perfection as possible. The advantages of proper street illumination cannot be over-estimated. Crimes decrease and values in both trade and property advance considerably when proper attention is given to the lighting of public streets. Nothing impresses a visitor to any city so much as the sight of well-lit thoroughfares, while the feeling of comfort and safety communicated to both residents and visitors alike is most desirable and gratifying.

dates back to the year 1906, when 26 one-light standards were erected on Beach avenue at English Bay between Bidwell and Chilco streets. Four years later those standards were changed from one-light to the present three-light type, using 3 60-watt mazda lamps, and later an additional 22 standards were added, bringing the total number of standards at this location to 48 in all. In March, 1910, several prominent citizens interested in Hastings and Granville streets, formed a committee, their object being to interest the property owners in the installing of ornamental cluster lighting on these two streets. Through the untiring efforts of the Granville Street Property Owners' Association, work on Granville street was commenced in the fall of 1910 and was completed in March, 1911. The work was carried out by the Electrical Construction Company, of Vancouver, the entire cost of same being paid for by the benefitting property owners. Arrangements were made with the city to take

NAME OF STREET	APPROXIMATE LENGTH OF STREET FEET	NUMBER OF STANDARDS	DATE OF INSTALLATION	NUMBER OF LAMPS UNDER STANDARD	SIZE AND KIND OF LAMPS	VOLTAGE OF LAMPS	HOURS OF BURNING	LAMP RENEWAL PER POST PER ANNUM	GLOBE RENEWAL PER POST PER ANNUM	INSTALLATION HOW PAID FOR	CURRENT HOW PAID FOR	INSTALLATION COST PER STANDARD	COST OF STANDARD PER YEARS BURNING
GRANVILLE	5000	25	85-90	5	75 WATT MAZDA	115	ALL TILL 12 P.M. ALTERNATE STANDARDS ALL NIGHT	83	2.60	PROPERTY OWNERS	CITY	250 per ft.	28.85
HASTINGS (BEACH TO HUBBARD)	4400	96	85-90	5	100 WATT TUNGSTEN	110	"	97	2.50	"	"	270 per ft.	33.05
HASTINGS (HUBBARD TO ALLEN)	1400	30	70-80	5	"	"	"	RECENTLY INSTALLED	LOCAL IMPROVEMENTS	GIFTS BY 25% OWNERS-75%	"	2.40 per ft.	RECENTLY INSTALLED
ALLEN	3400	88	85-90	5	"	"	"	"	"	"	"	2.56 per ft.	"
BEACH	4000	89	85-90	5	"	"	"	"	"	"	"	2.30 per ft.	"
CHILCO	2500	78	85-90	5	"	"	"	"	"	"	"	2.50 per ft.	"
BEACH (ALLEN TO BIDWELL)	3000	74	"	5	5 WATT MAZDA	115	ALL NIGHT	—	—	CITY	CITY	—	10.06
BIDWELL	"	10	"	2	10 WATT TUNGSTEN	110	"	—	—	"	"	—	"
COMMERCIAL BEIDGE	3,200	88	"	1	75 WATT MAZDA	115	"	—	—	"	"	—	5.79

General table showing details of Vancouver's cluster lighting system, cost, style of lights, etc.

Formerly an arc lamp suspended at a height varying from 20 to 30 feet above the ground was considered as being all right and perfectly in keeping with the requirements necessary, but in the present days of progressiveness in all growing cities, where good streets are being laid out and magnificent buildings erected, it has become essential that the poles or standards carrying the lighting units should not only fulfill that duty, but should also be of such a decorative nature as to lend themselves to the beautifying of the roadways in which they are placed. The extent of the decorative nature of the standards is merely a question of cost and every engineer is faced with the problem of getting the best style of standard most suitable to the occasion, at the least possible expense.

Vancouver's first installation of ornamental lighting

over this installation and pay for lighting and maintenance of same for a period of five years.

The good example shown by Granville street property owners was quickly followed by the erection of 96 standards on Hastings street. As the Granville street standards were found to be unsuitable for the multiple system of lighting, a new design was necessary, and through the good offices of the late Mr. J. A. McCrossan the present standard was devised, which after due trial, was found to be the most suitable standard for the requirements, and therefore was recognized as the universal one for any future ornamental lighting throughout the city. The installation on Hastings street was paid for by the benefitting property owners and an agreement, similar to the Granville street proposition was made with the city regarding lighting and maintenance.

* City Electrician, Vancouver.

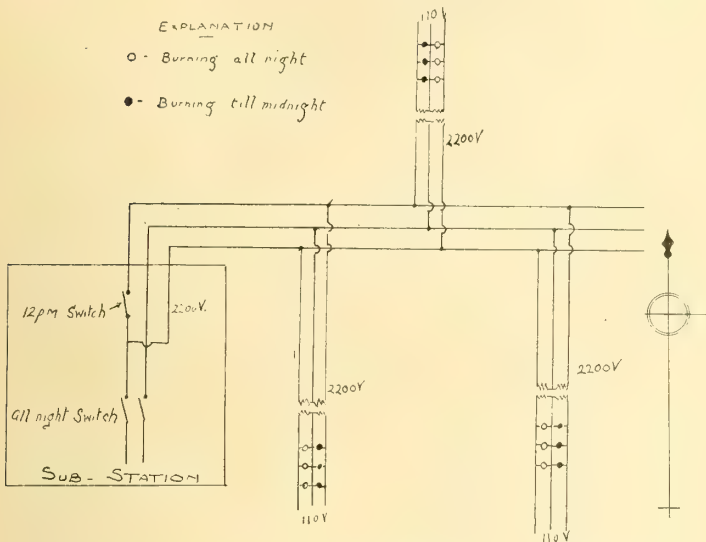
Before this work was completed several petitions had been received by the city council asking for the installation of ornamental lighting on other business sections of the city, and after due consideration the council in order to facilitate the work, passed a Local Improvement By-law on the 17th July, 1911. This by-law designated certain streets in the city of Vancouver upon which ornamental standard lighting should be installed and lighted, and that the cost of same should be defrayed by special rate upon

these are equipped with five 6.6 ampere series tungsten lamps connected in multiple at 11.3 volts. The service supplying the lighting is 110/220 volts, 3-wire, each service supplying approximately 12 posts on one circuit. The service leads are brought in conduit down the poles in nearby lanes, through the underground ducts and connected in multiple through transformers, located in the base of each standard and having a ratio of ten to one. The top lamp is in a 16-in. opalescent globe, and the side lamps are in 12-inch spherical opalescents.

With the exception of the lighting of the Granville street and Connaught Bridge, all standards are equipped with 5 100-watt tungsten lamps, wired in multiple at 110 volts on 3-wire system. Granville street bridge lighting consists of 70 2-light stem brackets, the lamps themselves being 11.3 volts, 6.6 amp. Twenty lamps are wired in series with automatic cutouts for each lamp. Ten similar brackets placed on the drawbridge are two in series with 110 volt, 100 watt tungsten lamps. The Connaught Bridge lighting system consists of 88 one-light brackets all wired in series having lamps of 11.3 volts, 6.6 amps., fixed in 'G.E.' series socket with film cutout. Regulation of this bridge lighting is secured by means of a regulator located in the Incinerator close by. This system was installed by the Electrical Construction Company and completed in December, 1911.

The general arrangement of the ornamental street lighting is such that all lamps burn till 12 p.m., and then alternate standards, with standards at diagonal corners at street crossings on the all night schedule. The accompanying diagrams give a general idea of the system of supply from substation to standards.

A new departure has been decided upon for any future extensions and that is the utilizing of steel armored cable for all underground work. This will not only ensure a decided saving in costs, both in labor and material, but should obviate a great many of the minor troubles common to the usual conduit system. A contract for an installation



Diagrammatic sketch showing supply from Sub-station to Standards

the assessed property on each street, according to the frontage thereon. An Amendment to this by-law was passed by the council on the 25th of September, 1911, to the effect that if a majority of the council considered it inequitable to assess the whole cost of the lighting and maintenance against the property owners benefitted, the council may defray part of this cost, but not more than 25 per cent. of the total, this to be paid out of the general funds of the city. On December 11, a contract was awarded to Waugh, Misner & Bailey to install ornamental lighting on Pender street Main street and Cordova street and on Hastings street from Main street to Jackson avenue. This installation comprising a total of 285 five-light standards, and covering an approximate distance of 12,300 feet, was completed in May of this year.

In retrospect it may be said that where three years ago Vancouver did not have a strictly ornamental tungsten street lighting system, at the present time it has about five miles of streets well lighted by this new system, and it is expected that by the end of the present year about $2\frac{1}{2}$ miles more will be added, bringing the total number of standards up to 791 and total mileage covered to approximately $7\frac{1}{2}$ miles.

Underground is naturally the system adopted to supply each standard. On Granville and Hastings streets a $2\frac{1}{2}$ -in. fibre conduit is laid in the sidewalk and imbedded in concrete. On the other streets sherardized conduit was used, and standard lead covered cable drawn through.

The spacing of the standards varies from 85 feet to 100 feet, according to the length of the block, giving a candle power of from 5 c.p. to 5.8 c.p. per lineal foot of the street. It is always the endeavor to place standards at each corner of street intersections wherever possible.

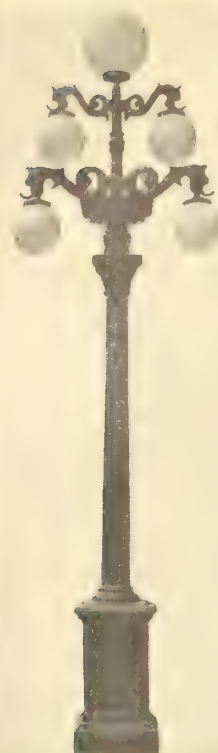
Two systems of lighting are in use:—The Granville street installation consists of 225 5-light standards. 113 of



Cluster lights on Hastings St., Vancouver

on this new system will be decided upon in the near future. The engineering department of this city are now providing a space of 6 in. on the boulevards of all the streets where there is any likelihood of ornamental lighting being installed. This will also tend to reduce the cost of the installations, and at the same time will prevent the otherwise necessary defacing of the concrete sidewalks.

The foregoing will show the grasp the city council has taken of the ornamental cluster lighting of their streets, and



Vancouver 5-light Standard

while always anxious to push this style of lighting, they are at the same time always on the outlook for something better suited to their requirements. Arrangements have just been made for a trial of the "G.E." ornamental luminous arc lamps. On Granville street between Broadway and Tenth avenue this trial is expected to be in operation during the first week in December. This is the same type of lamp as was installed at New Haven, Conn., last December, and which has made the city famous for its street lighting. The ornamental luminous arc lamp is the latest development in the science of street illumination. The light given is powerful, of high efficiency and low intrinsic brilliancy, and has a most pleasing appearance, being absolutely free from glare. The nature of this lamp renders it easily installed by means of an ornamental bracket to the steel or wooden poles carrying the overhead construction for street railways or light distribution, and therefore offers an admirable solution to the reduction of the number of poles on the sidewalks. The first installation of these lights is expected to be placed on Broadway from Granville street on the west to Main on the east. This will make Broadway a veritable "White Way" and tend to make it one of Vancouver's foremost business streets, not through the advertisement it will necessarily have in every trade and technical journal in the country, but also from a well-known axiom that good lighting is one of

the best advertisements that a merchant can have.

In line with the proposed new cluster light installation on Vancouver's thoroughfares, the municipal council has recently awarded a contract to Waugh, Mesner & Bailey, of Vancouver, for approximately 200 new standards to be located on Main street, Granville street, Harris street and Hastings street.

B. C. E. R. Social Club

The quarters of the B. C. Electric Social Club, an organization composed of the office employees of the B. C. Electric Railway Company, Limited, at its head office in Vancouver were formally opened on the evening of November 1st. Over 300 of the office staff participated in the function crowding the large social hall to its utmost capacity as well as occupying the other rooms of the quarters. The Club quarters were formally declared open by acting general manager Conway. This arrangement was appropriate as the idea of the Club originated with the management of the company and its formation was carried out under the direction of a committee of officials appointed by it. Mr. C. C. Rummell, Chairman of the club committee, occupied the chair during the evening and Mr. George Kidd, comptroller, also participated in the evening's exercises.

In declaring the Club open, Mr. Conway alluded to the efforts of the management to promote the welfare of their employees. He stated that when the plans for the company's new head office block were being considered the question of architecture as opposed to the convenience and comfort of the staff come forward at one point and the sentiment of the company was promptly expressed to the effect that comfort and convenience were of greater importance than architectural attainment. He stated that the idea of the club had originated with the management and great interest had been taken in its development as the committee in charge worked out their plans. He was certain that the men would appreciate the efforts of the company for their comfort and convenience and the result would be a spirit of co-operation between the company and its employees such as



The office staff of B.C.E.R. Co. participating in the Club Opening

was especially desired in a corporation such as the B. C. Electric which now had on its pay-roll over 5000 employees, the staff of the Vancouver office alone being composed of several hundred.

The remarks of Mr. Conway were greeted with hearty applause showing the good spirit existing between the management and the office staff, and the appreciation felt for the efforts put forward in the provision of the club quarters.

The club quarters are located on the second floor of a large brick block directly in the rear of the company's head office. From the vestibule, members enter a large room, 18 by 56 feet in size, which is used as a social hall. This is handsomely panelled and equipped with a very large fireplace around which the members may gather. Around the walls of the room are placed over a hundred photos showing the plants and operations of the company at various points. For musical evenings a piano is provided. In the rear of the social hall is located the steward's office, coat room, etc. From the social hall, entrance is made into the billiard room where is now placed a full sized billiard table and a pool table, the room being of sufficient size to accommodate an additional table as the club grows. Beyond the billiard room is the games room where tables are provided for games of various sorts. At the extreme end is located the reading room which is one of the most popular rooms of the club, its racks being equipped with all the latest English and American illustrated magazines and periodicals. In keeping with the personnel of the club special attention has been given to the provision of technical literature, a wide range of periodicals covering the electrical and engineering fields being offered. Throughout all the rooms provision has been made for the comfort of the members in comfortable Morris chairs, leather upholstered rockers, lounging seats, etc. The employees attending the opening of the club unanimously pronounced the arrangements made to be as near perfect as possible, and lavish praise was given the committee for its forethought and care.

The quarters of the club are given by the company rent free and light is also provided without charge. In addition to these concessions the company also made a handsome grant, completely covering the cost of alterations to fit the premises for club purposes and provide the handsome equipment enjoyed by the members. The club has already become a popular place in the life of the B. C. Electric office staff, the rooms being well attended both during noon hours and at night. The organization enrollment will probably be about 250. Until the close of the year the club will be controlled by the committee selected by the management after which the members will choose their own officers.

Public Service Corporation

The Public Service Corporation, a company comprising a number of prominent Vancouver lumbermen were recently given permission to prepare an agreement under which it is proposed that the city of Vancouver grant the company a franchise for the use of city streets and lanes for conveying steam heating pipes and electric wires and conduits. Several conferences have lately been held between the millmen and the "smoke and sawdust nuisance" committee, of the city council, with the result stated. It is the intention of the company to develop electricity and steam heat from the refuse at the various city mills. Mr. W. I. Paterson, who is taking an active part in furthering the scheme, stated that it was hoped to generate at least 20,000 horse-power from the mills, and at the same time to do away with a great deal of smoke and sawdust. It is proposed that a \$50,000 plant be first installed in the Hanbury Mill to generate at least 3,000 horse-power, and it is further stated that the concern will be in a position to produce electricity cheaper

than any of the other companies at present operating in the Vancouver field.

The franchise was drawn up to extend for 40 years, the city having the right to purchase it any time after 20 years. The civic committee decided to ask for ten per cent. of the company's net profits, a ten per cent. company dividend first being subtracted. The corporation agrees to supply the city with electricity according to the following schedule of rates:

- (a) A maximum rate of eight cents per kilowatt hour, with a continuous load factor of forty per cent.
- (b) A maximum rate of seven cents per kilowatt hour, with a continuous load factor of fifty per cent.
- (c) A maximum rate of six cents per kilowatt hour, with a continuous load factor of sixty per cent.

The corporation further agrees to supply the city with heat at a maximum rate of one dollar per thousand pounds of steam.

It was explained that the continuous load factor of so much per cent. was necessary as the cost of producing 40 per cent. of the plant's capacity was just as great as the production of 100 per cent., but that owing to the smaller consumption the revenue was necessarily that much smaller. As the continuous load factor increased, the smaller charge for service would be possible, and the city would get the benefit of it. As a basis of discovering just what the continuous load factor was, a rider was inserted in the franchise agreement providing for the access of city officials to the company's books and plant to ascertain the amount of electricity produced and used from time to time, and to determine the rates to be charged by the company. The revised franchise will be considered at an early meeting of the city council when a by-law will be passed for its submission to the vote of the people.

B. C. E. Co.'s Steam Auxiliary Plant at Brentwood Bay, Vancouver Island

On November 7th steam was turned on at the new auxiliary plant of the B. C. Electric Railway Company, Ltd., on Vancouver Island, representing the completion of an additional source of power for the company's patrons in Victoria and the Saanich Peninsula. The outlay represented by



General View of Brentwood Plant

the plant is about \$400,000. The contract for the work was awarded last summer and the contractors have been working day and night in order to have the unit ready for service at the earliest possible moment.

The new plant of the B. C. Electric is located on the

water front at Brentwood Bay, about 12 miles from Victoria, and on the west coast of the Saanich Peninsula. The present output of the plant is 6000 h.p. but arrangements have been made for extensions, as the need develops, which will double its output. The power house is constructed of reinforced concrete and is 170 by 140 feet in size and one storey in height. The layout of the building is arranged after the latest type of steam auxiliary plants on the continent, every care having been taken for economy of space and facility of operation. Viewing the plant from a distance, the predominating feature is the great reinforced concrete smoke stack which rises to a height of 248 feet and has an internal diameter of 17 feet 5 inches at the base, narrowing to 11 feet on top.

The steam equipment of the plant consists of six boilers of the Babcock & Wilcox type, each of a capacity of 480 h.p. The contract for this part of the work also provides for the full equipment of Wheeler admiralty condensers, centrifugal pumps, etc. The boilers will be equipped for the use of fuel oil, this being the first plant of the company which has been fitted exclusively for this method of operation. Two large oil tanks of a capacity of 10,000 barrels each and two auxiliary oil tanks are located near the building, the installation for the storage of the oil having been arranged in accordance with the fire underwriters' rules.

The electrical units of the plant at present ready for service are two in number, each consisting of a 2000 kw. Allis-Chalmers-Bullock turbo-generator. The exciter for each

Electrical energy will be used to the extent of from 2000 to 3000 h.p.

The work of installing the Brentwood Bay power plant was carried out by C. C. Moore & Company of Seattle and San Francisco, who have previously installed plants of a similar character for the B. C. Electric in Vancouver. The completion of this plant gives the B. C. E. R. Co. an available output of 22500 h.p. on Vancouver Island, the other sources of energy being 12,000 h.p. from the Jordan River hydro-electric station, 3000 h.p. from the Goldstream hydro-electric station and 1500 h.p. from the steam auxiliary in Victoria. This will be increased in the near future by the doubling of the capacity at the Jordan River plant, operations on which are already in progress. This great increase of power will find a ready market because of the large amount of settlement now going on around Victoria, the development of the Saanich Peninsula and the growth of industrial undertakings on the Island. The development of the Saanich Peninsula will probably be very rapid next year, owing to the opening of the B. C. Electric interurban line from Victoria through the centre of the Peninsula to Deep Cove. This line, 22 miles in length, passes through a rich agricultural section which will doubtless be the site of small farms and market gardens as well as suburban centres of population. A branch from the main line will extend to Union Bay where the B. C. Electric control a large estate which, with the operation of the line, will be laid out as a pleasure resort and suburban town-site.

Victoria B. C. E. R. Items

The steam plant at Brentwood Bay, Saanich, is now ready, putting a further 6,000 kw. at the disposal of the company.

The newly formed Municipality of Esquimalt adjoining the city of Victoria are calling for tenders for the installation of a system of street lighting.

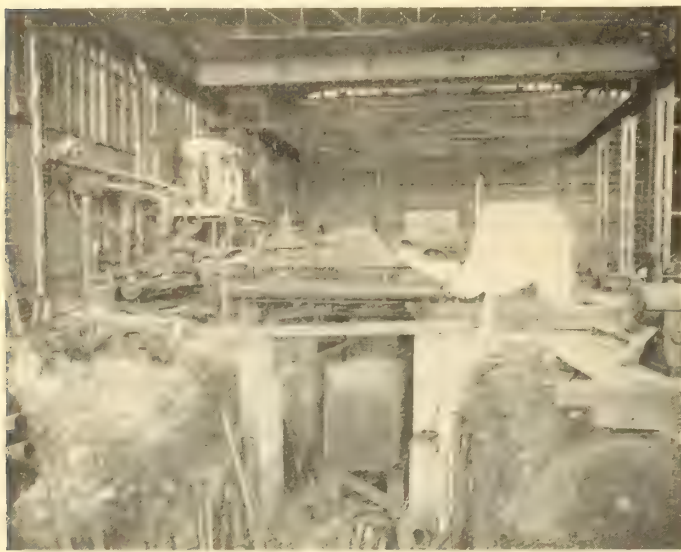
Mr. F. D. Picken, for two years chief dispatcher of the company in New Westminster, has been transferred to Victoria to take up the position of superintendent of the Victoria-Saanich interurban line.

The second unit at Jordan River has been put into commission, bringing the output now up to 12,000 h.p. The company has decided upon a further expenditure of \$1,500,000 to double the capacity of the present plant.

The laying of rails for the new interurban line into Saanich is progressing well. The line is ready for operation as far as Tod Inlet, and it is expected to complete the line to Deep Cove by the end of the year.

The B. C. Electric Railway Company, Limited, have commenced work on an extension of the Willows car line to reach the "Uplands." The line will run near the Willows Beach district. It is expected to operate the additional line by Christmas.

The demand on the B. C. Electric Railway Company for lighting and power in and around Victoria continues to increase at a very rapid rate, the average residence lighting connection being 15 per day for some time past, and power has increased 300 per cent, during the past twelve months.



Installing Equipment at Brentwood Bay

generator has a capacity of 75 kw. The generating equipment is fitted with a full set of the most up-to-date switches etc.

At the present time there is being constructed at the side of the generating station a transformer house, 53 by 80 feet in size and of reinforced concrete construction. Within this structure will be located three banks of oil insulated water cooled transformers, each bank consisting of three transformers each of a capacity of 2,000 kw.

Work is now in progress on the construction of transmission lines connecting the power house with the company's system. One of the chief power lines from the station will be that to the plant of the Portland Cement Construction Company at Bamberton Bay, for which the B.C.E.R. Co. will supply power. This cement plant has been in process of installation throughout the year and will start operation early next year. It will represent an investment of about \$2,000,000 and have a capacity of 2000 barrels of cement per day.

Canada's Busy Prairie Provinces

Port Arthur has recently installed a most modern and complete Fire Alarm System.

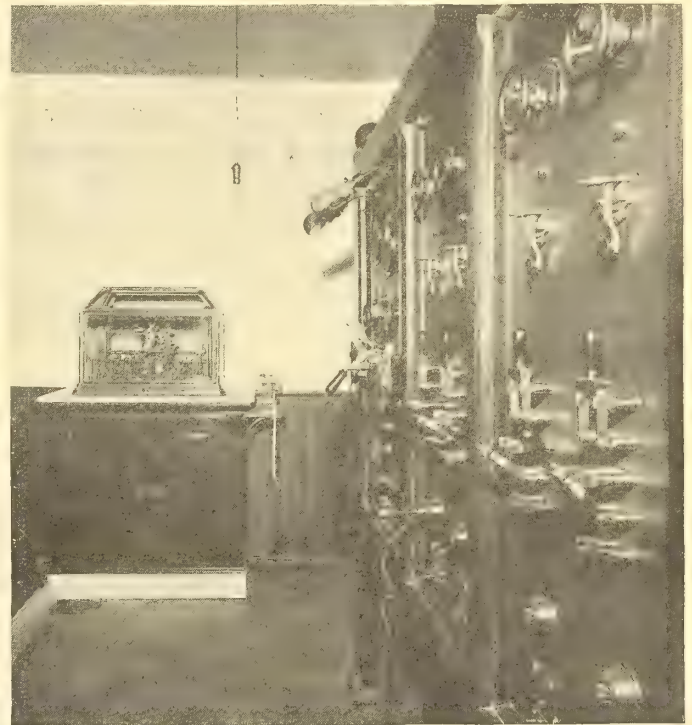
The city of Port Arthur has recently installed a new complete fire alarm system, with a central office equipment including a 4-circuit repeater, 50 fire alarm boxes, and from 20 to 25 miles of No. 10 copper wire. The system is one of the most up-to-date in every respect of any in Canada. This battery is in two sets, the "A" and the "B" sets, and is charged from a motor-generator set. The switch-board, which consists of a one-panel charging board and two two-circuit panels, with the storage battery, motor-generator, and four-circuit repeater is set up in the central fire hall. The boxes are of the non-interfering type and are divided up into four circuits covering the entire city. Over each box a red light has been placed, so that at night anyone wishing to notify the Fire Department can at once locate a box from which to send in a call. On the first blow from the box the horses are released from their stalls, the punch register stamps out the number on a tape, and the indicator over the fire station gong displays the number of the



Fire Alarm box on pole—Inserts show nearer views of Box

box from which the alarm was sent in. At the same time the tower bell in the belfry over the fire hall strikes out the number of the box, and a stop-clock which is also part of the equipment stops, thereby allowing the time to be recorded when an alarm comes in. Should two hooks be pulled in two separate circuits at the same time, the repeater at the central office locks out one or other of the circuits, at the same time transmitting the call having the right of way over the alarm circuits. In connection with the fire alarm system, a private telephone system has been installed and by means of this system anyone wishing to notify the Fire Department of a fire in his vicinity has only to call central (in the ordinary way), state that there is a

fire and give the location, and instantly the fire halls throughout the city are notified and in a very few seconds the apparatus is on its way to the scene of the fire. The system was installed by the Northern Electric and Manufacturing Co. of Montreal. A detailed description of the equipment and the functions of each part, is given below.



Storage battery switchboard—Register in rear

The system consists of the following apparatus:—

- 1-4 circuit Northern Electric Type manual storage battery switchboard mounted in oak frame.
- 1-4 circuit automatic N. I. repeater.
- 50 No. 3-B N.I. weight sector fire alarm boxes equipped with Cole key guards and instructions cast on outer door.
- 2-15 in. combined gong and indicators.
- 2-10 in. electro-mechanical turtle gong.
- 1-6 in. electro-mechanical turtle gong.
- 1-No. 3 automatic bell striker complete.
- 1-Ideal punch register.
- 1-60 in. double battery rack equipped with porcelain and glass insulation.
- 86 cells of "BT" type storage battery.
- 17 miles of No. 10 B&S hard-drawn double braided copper wire.

The 50 fire alarm boxes are well distributed over the entire city. In the business section where the fire hazard is greatest the boxes are so arranged that in case of fire in that particular district the party sending in the alarm will not be compelled to run more than 400 feet to any one fire alarm box. When any one of the 50 boxes are operated for fire the signal is automatically recorded on gong and indicators at both hose houses and is also received at the pumping station on a 10 in. turtle gong.

The Ideal punch register at the central station automatically records the signal so that a record of all fires is always filed at that point. There is also a 6 in. gong installed in the chief's residence so that in case of an alarm

of fire coming in while the chief is at home, he receives the signal at the same time as it is received at the fire station. The alarm from any one box is also given from the firebell by means of the automatic bell striker located in the tower at the central station.

The system is divided into four separate and distinct circuits and whenever any one box is pulled the signal is automatically transmitted over the entire system by means of the repeater. This repeater being positive non-interfering in its operation will allow only one call to be transmitted at any one time so that there is no conflict in the signal should boxes be pulled simultaneously on two different circuits. Boxes are also of the non-interfering type whereby if two should be pulled at or about the same time there would be no interference in the signal; either one of the boxes would automatically give its four rounds of complete signal.

The stations are also equipped with stall trips which automatically release the stall doors upon the first blow of the signal from any one box. An engine-house stop clock is also installed which records the exact minute that the alarm was received at the fire station.

The storage battery is charged through a motor-generator set, controlling devices for which are mounted on the four circuit storage battery switchboard. A protector board is mounted on a wall where fire alarm circuits enter the central station. This protector board is equipped with lightning arresters and fuses so that in case the fire alarm circuits should become crossed with any foreign currents the

In addition, the city is building a modern fire hall on Hill street, which is on one of the highest points of the city. This station will be equipped with a 500 gal. per minute Waterous Steamer, a combination hose and chemical, and about seven permanent men. This is in addition to the central fire hall at present equipped with fourteen permanent men. The ratepayers have further approved the pur-



Storage battery mounted on Rack

chase of an 80 h.p. combination hose and chemical auto truck, this to be put in service at once.

With these additions the city of Port Arthur will have one of the best departments for fire fighting purposes in the Dominion. The public utilities of the city are under the management of a Commissioner of Utilities, Mr. J. J. Hackney, who had direct charge of the installation of the system described above.

Gas Producer Plants in the West

The smaller towns in Western Canada have grasped the idea of the cheapness of gas-producer plants, and quite a number of these are being installed at the present time by the British Canadian Engineering & Supply Company. This company are agents for the well-known Ruston, Proctor & Company, of Lincoln, England. Among the recent contracts are the following: The town of Hanley has awarded the contract to the above company for a 50 h.p. producer-gas engine and plant together with all electrical equipments. The town of Wadena has also given an order for a 50 h.p. plant. The town of Gull Lake has placed a contract for a 64 h.p. equipment of the same make; the town of Outlook is installing a 72 h.p. similar plant and within the last few days Rapid City, Man., have placed their order with the British Canadian Engineering and Supply Company for a 50 h.p. equipment with all accessories.

Farmers Inter-urban Electric Railway Co.

Power is being sought from the Quebec Legislature to construct an electric railway from Riviere des Prairies, Parish of Pointe aux Trembles, P.Q., to St. Anne de Bellevue, and from St. Laurent to St. Jerome. The name of the company is the Farmers' Inter-urban Electric Railway Company.



Motor-generator set—Repeater shown to right

fuses will protect the magnets of the different pieces of apparatus in the central station.

The outside line construction consists of about 17 miles of No. 10 B&S gauge hard-drawn double-braided copper wire which is run on 2-pin crossarms underneath all other wires and cables. The leads running from the main line to the fire alarm boxes are No. 14 B&S gauge, rubber covered and double braided copper wire.

Since this installation was completed orders have been received from the Western Dry Dock & Shipbuilding Company for two fire alarm boxes for their works and these will be added to the system, making 52 fire alarm boxes in all.

Ornamental Lighting in Moose Jaw

The city of Moose Jaw has just installed fifty 5-light standards as illustrated herewith. The base of this post is 20 inches square and is provided with lugs on the inside for receiving the bolts which are set into a concrete foundation. This conceals them from view when the post is set up. Access may be had to the nuts when placing them on the bolts and also to the interior wiring and cutouts by means of two large wiring doors in the base.

The column is fluted and tapers from 8 inches diameter at the base to 4 inches diameter just below the top. This gives the column a graceful appearance and does not obstruct the view along the street so much as does the ordinary column which is heavy at the top.

The height from ground to bottom of lower globes is 10 feet and to the top of the top globe 14 feet 8 inches. The distance from center to center of globes on the lower cross-arm is 36 inches and on the top cross-arm 24 inches. These proportions place the globes in a triangle with the top globe at the apex and distributes the light in such a way as to give a good amount on the streets and a proper proportion on the show windows and building fronts.

The post is made of a good quality of gray iron throughout. In the foundry where they were cast no scrap is used, such mixtures of the pig being made as to give the proper analysis, and this is found to be more uniform by excluding all scrap iron.

The standards were manufactured by the George Cutter Co. of South Bend, Indiana, and supplied through their agents the Canadian H. W. Johns-Manville Company.

Things are beginning to assume a satisfactory shape at the Moose Jaw municipal power generating station which was completely destroyed a few months ago by fire. The walls of the power house are well up. A 1000 kw. turbo-generator has been operating for some time, the connections having been made temporarily. Another 500 kw. turbo-generator has also been delivered and will be placed on its foundations without delay. Already the load is beginning to tax the larger unit alone and all haste is being used to get the complete equipment in shape for the winter peak loads.

Edmonton's Light and Power

It is customary for the city of Edmonton Electric Light Department to estimate the revenue from electric power consumers annually. The gross revenue estimated for the year 1912 from light consumers was \$250,000; power sales, \$40,000.22; street lighting, \$20,000; miscellaneous (goods purchased and sold) \$5,000. As indicating the rapid expansion of the city, however, these figures have been greatly exceeded. The total amount of revenue received for the eleven months ending October 1st, 1912, was \$255,337.43 for lighting sales only and for power sales \$36,870.91. This leaves still another month of revenue to be added which will increase the lighting amount to \$280,000 and the power revenue to \$45,000 for the year 1912. The rates for lighting are straight 8c per kw.h. less five per cent. discount. For power there is a sliding rate from 3c to 7c, de-

pending on the amount consumed between 300 and 1200 kw. There is a minimum charge on motors of \$1.00 per month per h.p. connected. The cost of energy per year per kw.h. purchased from the power house at the bus-bars was 3.2c. The total surplus for the year, estimating October similar to September, is \$85,695.

This has been a very heavy year and the increases have been phenomenal. For example, in lighting services for September, the increase in number of 5 and 10 amp. meters connected was 515; the number of motors connected for the month of September was 35, total h.p. 187. The city have also recently purchased from the Canadian Westinghouse Company additional street lighting equipment of luminous arc lamps, and from the Canadian General Electric Company a complete station equipment and lamps, consisting of 75 of the new inverted type luminous arc lamps which will be installed on ornamental standards. After careful examination of street lighting, visiting practically all cities on the coast through to Portland and the different provinces, Alberta, Saskatchewan and British Columbia, the Lighting Department have reached the conclusion that the luminous arc lamp of the inverted type is the coming lamp for street illumination. The five-light standard is very nice and a great many of the cities have adopted this class of lighting, but for wide streets of 80 feet or over the five-light standard

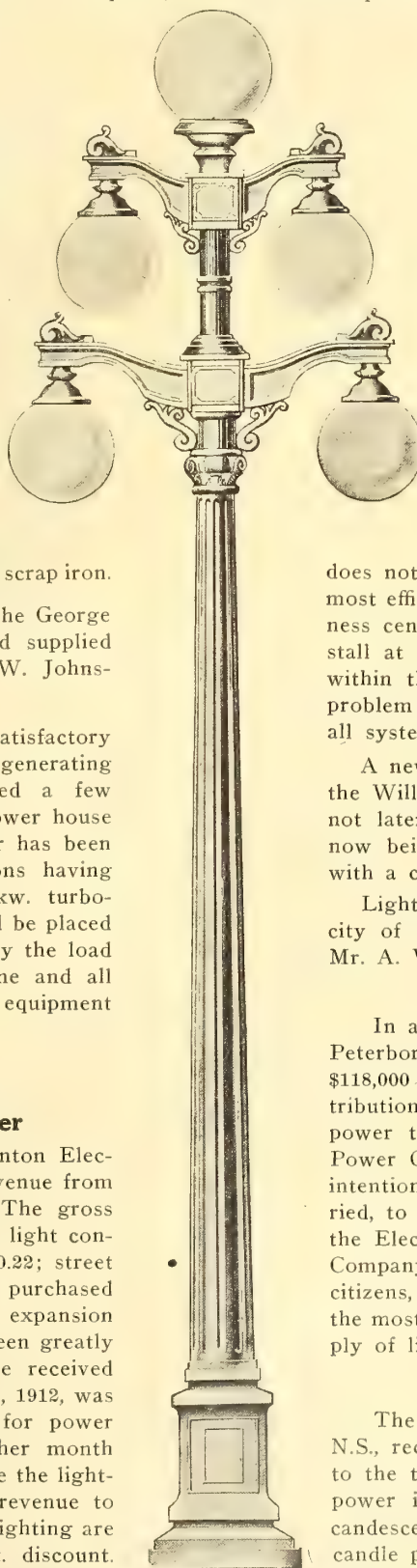
does not give sufficient light. The arc light is the most efficient and is especially adapted for the business centre of any city. It is the intention to install at least three more equipments in Edmonton within the next four months. The street lighting problem of this city has been let stand over so that all systems might be fully investigated.

A new 2,000 kw. steam turbine manufactured by the Willans & Robinson Company will be installed not later than December 1st. Specifications are now being issued for an additional steam turbine with a capacity of 4,000 kw.

Light and power is a separate department in the city of Edmonton, operating under the control of Mr. A. W. Ormsby as superintendent.

In all probability a by-law will be voted on in Peterborough at the January elections providing \$118,000 for the establishment of a municipal distribution system in connection with a supply of power to be obtained from the Hydro-electric Power Commission of Ontario. The Commission's intention appears to be, in case the by-law is carried, to expropriate certain of the water powers of the Electric Power Company. The Electric Power Company is also submitting a proposition to the citizens, which on the face of it, appears to offer the most satisfactory solution for a satisfactory supply of light and power in Peterborough.

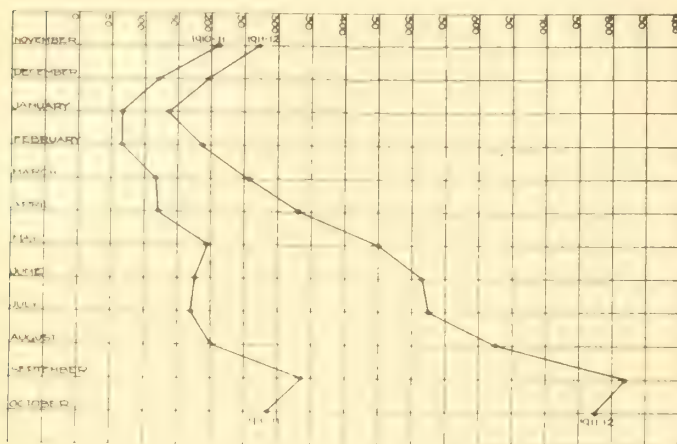
The Cape Breton Electric Company, of Sydney, N.S., recently submitted the following yearly rates to the town council:—arc lamps \$86.07; 200 candle power incandescents, \$62.62; 40 candle power incandescents \$19.09. The council accepted the 200 candle power lamps as being the most suitable for their purpose.



Moose Jaw

Electrical Inspection Department—Edmonton

The accompanying chart indicates the marked increase in the amount of business done by the electrical inspection department of the city of Edmonton during the last two years. The whole work is carried out under the supervision of Superintendent Ormsby, who has a chief inspector and four assistant inspectors under him. The receipts for permits issued on inspections for the twelve months ending



Permits for Electric Inspection—Edmonton

October 31, 1912, was \$4,001.95; salaries and miscellaneous expenses amounted to \$2,942.32, leaving a net credit balance of \$1,059.63. The following list of fees for electrical inspection permits will be of interest:—

For each permit to install additional wiring or fittings or to alter or repair same, whether for lighting, motor, etc., charge to be as follows:

One to three lights	... .. \$ .35
Three to five lights	... .. .65
For each additional five lights	... .. .35
Altering motors, changing wiring, etc., minimum charge	... .. .65

These charges apply only where additional lights are added to a service already connected to the supply.

For each inspection or re-inspection on old wiring or fittings, minimum charge65

Incandescent Lighting

When permit is taken for work complete, wiring and fittings are to be ready for inspection at the same time.

From 1 to 10 lights, covering wiring and fittings	... .65
Covering wiring only or fittings only	... .50
From 11 to 20 lights covering wiring and fittings	.. 1.25
Covering wiring only or fittings only	... .95
From 21 to 40 lights, covering wiring and fittings	.. 1.90
Covering wiring only or fittings only	... 1.25
From 41 to 60 lights, covering wiring and fittings	.. 2.50
Covering wiring only or fittings only	... 1.90
From 61 to 100 lights, covering wiring and fittings	... 4.40
61 to 100 lights, wiring only or fittings only	... 3.50
101 to 125 lights, covering wiring and fittings	... 5.65
101 to 125 lights, wiring only or fittings only	... 4.25
Each additional 25 lights, wiring or fittings	... .65

All May-Oatway and similar fire alarm systems shall be subject to inspection. Inspection fee, \$2.00.

Note—Nernst lamps to be classed as incandescent.

Arc Lighting

Size of installation	Covering Wiring & Arc Lamps complete	Covering Wiring only or Arc Lamps only
One Arc Lamp	... .. \$ .65	... .. \$ .35
Two Arc Lamps	... .. .95	... .. .65

Three to five Arc Lamps.	1.60	1.25
Six to ten Arc Lamps	1.90	1.25
Mercury Vapor Lamps to be classed as Arc Lamps.		

Motors

For each motor not exceeding 1 h.p.	... .. \$ .65
For each motor exceeding 1 h.p. and not exceeding 5 h.p.	... .. 1.25
For each motor exceeding 5 h.p. and not exceeding 10 h.p.	... .. 1.60
For each motor exceeding 10 h.p. and not exceeding 15 h.p.	... .. 1.90
For each motor exceeding 15 h.p. and not exceeding 20 h.p.	... .. 2.50
For each motor exceeding 20 h.p. and not exceeding 50 h.p.	... .. 3.75
For each motor exceeding 50 h.p. and not exceeding 100 h.p.	... .. 5.00
Portable Fan Motors, minimum charge	... .. .35
For each additional meter loop	... .. .35

Provided that should any installation not be completed in accordance with the date specified in application and unnecessary delay is caused by the contractor or party to whom the work has been in charge of, a further fee of 50 cents per visit shall be paid for each inspection.

Sign, Decorative and Temporary Lighting

For sign work or decorative wiring, whether temporary or not, a minimum fee of 65c shall be paid for each installation of 50 lights or under, and an additional fee of 65c for each additional 50 lamps or fraction thereof.

Electric Heating Device

No charge will be made for permit on heating devices including irons, but unless the permit is taken out in the usual way the penalty of the By-law will be imposed.

Special Inspection and Re-inspection Fee

A fee of 65c per hour shall be paid for services of each inspector when inspection is made on request of owners or other interested parties.

Manitoba's Public Service Commission

Commission Government and regulation is rapidly becoming accepted as the best method of adjusting the relations between public service corporations, whether privately or municipally operated, and the public. Such corporations by the nature of their functions are inherently monopolies, and proper regulation of such monopolies is greatly to be preferred to a senseless competition which is necessarily wasteful and at the same time fails to serve the public good in the highest measure. The introduction of Public Service Commissions in the United States has resulted in a distinct improvement in the relations between the people and the corporations, wherever a fair and intelligent trial has been given, and in many places the private companies are coming voluntarily under the jurisdiction of the commissions, which insure them a reasonable return on the actual capital invested, and protect them from unwarranted rate cutting or unnecessary competition, while at the same time insuring to the public the best possible service at the lowest cost.

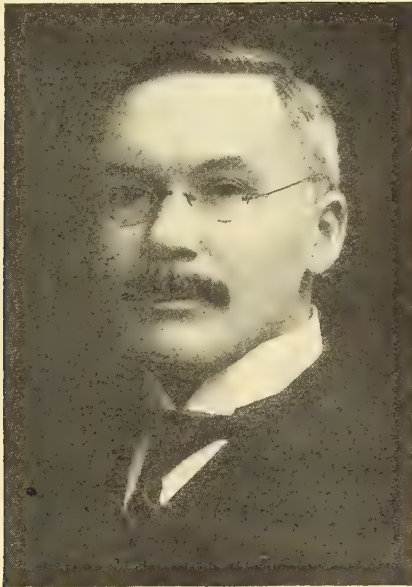
With these ideas in mind, the Public Service Commission of Manitoba was created at the last session of the Provincial Parliament in February, 1912. A careful study of the various public service commissions in the United States was made by the Premier, Sir Rodmond Roblin, and the Hon. Colin Campbell, who are principally responsible for the act, and in this act the good points of these commissions were incorporated. The feature in which this commission differs most from others is that there is but one commissioner, who has wide powers and an organization and procedure unhandicapped by excess of red tape and formality. The act places under his jurisdiction all public

utilities in the province, such as telephones, telegraphs, railways, street and interurban railways, water, light, heat and power systems. The various municipalities may come under the provisions of the act by the passing of the necessary by-laws, and this has already been done by the city of Winnipeg. The Commission may, in addition to hearing appeals, initiate investigations into various matters of public welfare, as will be shown later. The decisions of the Commissioner on any matters under his jurisdiction are final and binding, save that in certain cases on matters of law, appeal may be made to the Court of Appeals.

As in other large and rapidly growing cities, so in Winnipeg, there are many problems that require the aid of

he does, the respect and confidence of all who know him, his work as Commissioner is almost certain to be attended with satisfaction and benefit to all concerned.

Commissioner Robson is ably assisted in his work by Mr. A. Wilson Smith who was appointed by the Provincial Government as secretary of the Commission. He has been for many years in the Court of Kings Bench as accountant and chamber clerk. The offices and departmental work are under his charge and he has followed largely the system of the Dominion Railway Commissioners in filing and keeping records. The offices of the Commission are located in the Somerset Block, Winnipeg.



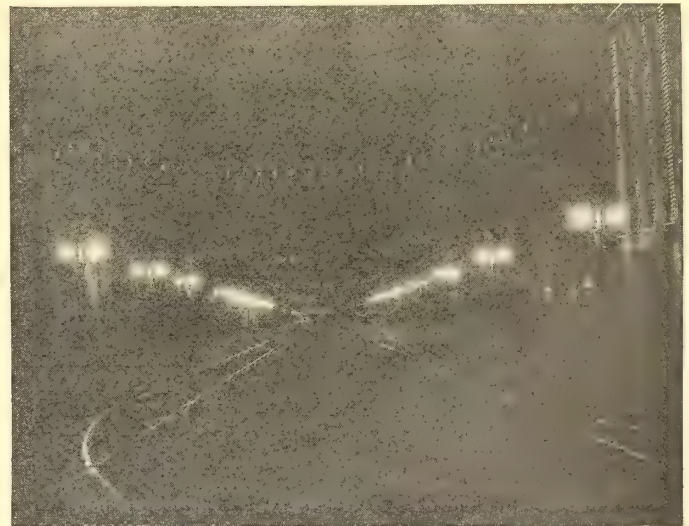
Commissioner Robson

such a Commissioner in arriving at a rapid and satisfactory solution. Among these may be mentioned the water problem, an independent investigation of which was initiated by the Commission under the direction of one of America's most eminent engineers in this line, and which resulted in a vote by the people committing the city of Winnipeg to the expenditure of millions of dollars for a pipe line to a first class supply of soft water at Shoal Lake, eighty miles distant; this will be a great boon to Winnipeg and the surrounding country. Another case in point is the joint use of poles and conduits in Winnipeg, a matter of great importance now under consideration, and a settlement of which may be expected soon. Further, the Commissioner has recently ordered an important change in the entrance of the Winnipeg, Selkirk & Lake Winnipeg Railway, an electric line into the city, which will result in the construction of a large and thoroughly up-to-date terminal at the northern city limits. These and many smaller questions are but the commencement of the Commission's work, which promises to be one of great importance to the province.

The Government has been most happy in their choice of a Commissioner in the person of Hugh Amos Robson, K.C., who was born in England in 1871. He studied law in Regina and became Deputy Attorney General but later came to Winnipeg where he was associated with the law firm afterwards known under the firm name of Aikins, Robson & Co. In 1911 he was made Judge of the Court of Kings Bench, but resigned to accept the appointment as Public Utilities Commissioner. Judge Robson is a vigorous man with a keen sense of his responsibilities, of unimpeachable integrity, a close student of the great present day problems affecting the welfare of the people, and is considered to be one of the ablest legal men in the province. Possessing, as

Decorative Lighting in Winnipeg — Special Efforts for the Duke and the Oddfellows Convention.

With so large an amount of cheap power at the disposal of the citizens, decorative lighting on the principal downtown streets has become quite a noticeable feature in the city of Winnipeg. It was seen at its best this summer during the visit of the Duke of Connaught and the Princess Patricia, and during the Sovereign Grand Lodge of the Oddfellows, September 15th to 21st. The accompanying cuts will give some idea of the appearance of Portage avenue and Main street at the time of the latter event. The erection of the 125 ornamental standards by the city was pushed to completion, until these formed an unbroken line from the Canadian Pacific Railway Company's hotel, the Royal Alexandra, down Main street to a point near the new Union Depot, and out Portage avenue for a considerable distance. These standards are mounted about eighty feet apart and are equipped with two 6.6 ampere magnetite arc lamps. One of the cuts indicates the appearance of these standards in day time. In addition to the completion of these standards, the city also let contracts for the erection of a large



Main Street, Looking South—Winnipeg

amount of purely decorative lighting. This comprised two contracts, one for overhead festoons on the city streets, and the other for the decorating of the City Hall, costing \$7,000 in all.

The City Hall, with its many cornices and turns, was a rather difficult proposition. As the decorations were intended to be permanent, all wiring was done in conduits with approved outlets and fixtures. The outlets above the cornice line were type J condulets, while those below the cornice line were style No. 2 Appleton unilets. All conduit and fittings were galvanized. In order to ensure positive contact, all joints were soldered. There were used altogether 1,100 5-c.p. carbon lamps set 14 inches apart.

... was used in all branch circuits and the drop from the service entrance was kept below three per cent. by careful planning of circuits. The conduit and fittings were all wired complete on the ground and fastened to a 1-in. x $\frac{1}{8}$ -in. galvanized strap which was fastened to the building every four feet. It was necessary to scaffold the building for the erection of the fixtures, which took about 25 days. One of the figures shows the appearance of the building at night.

The other section of the decorative lighting done by the city was that of the overhead festoons. There were erected 63 of these festoons, 125 feet apart, each having 56 5-c.p. lamps. The extreme width of the streets made this a more difficult problem than it would be in most cities. $\frac{3}{16}$ in. messenger cables were strung across the street at a uniform height, and fastened to buildings by means of small brackets fastened to the wall by four 2-in. x $\frac{1}{4}$ -in. Pierce bolts. Tests showed that the hooks would straighten before the bolts gave any sign of pulling out. The festoons were made up to a uniform length on a frame built on a vacant lot near the contractor's shop, so that they would hang uniformly when erected. No. 8 wire was used with the decorative receptacles. As festoons were hung above the trolley wires, a high tower wagon was necessary. This was raised and lowered to clear the trolley span wires by two men. The festoons were laid out on the street and lamped, then pulled in place, and snapped into the rings on the messenger cable by harness buckles. A feature of the Odd-Fellows decorations was the triple links, erected as shown in the accompanying cut, and outlined at night in red lamps. The highest point it was necessary to reach with the tower wagon was twenty-eight feet, or about ten feet above the trolley wires. These festoons were fed by a special underground circuit from the substation, and were connected in on one end only. They make a much better appearance than the cut shows, forming a kind of golden canopy over the streets, the brightness of the magnetite arcs emphasizing the yellow tinge of the carbon lamp. It is also intended



Decorative Lighting on T. Eaton Store—Winnipeg

that the festoons will remain up permanently. The layout of the ornamental lighting was done by Mr. F. A. Cambridge, city electrician, and all of the construction under the direction of Mr. Schumacher, manager of the Mitchell Gray Electric Company.

The various business houses put on holiday attire in the shape of electric lights, and one of the most striking displays was that covering almost the entire front of the T. Eaton big Winnipeg store. The many moving picture theatres in the city are also very prodigal in their use of light, and provide an interesting display in themselves. The

recently completed Bank of Montreal on the corner of Portage avenue and Main street, erected temporary decorations that were very effective. The light was furnished by tungsten lamps mounted in Benjamin reflectors standing out about eight feet from the building. Many other banks and business houses were effectively decorated, most of them making permanent installations of the lighting fixtures. It may be noted in passing that Winnipeg has now over 2,000 arc lamps, of which about 1,000 are the d.c. magnetite type, which has been adopted as standard, and there will be added next year about another thousand, so that the old type



City Hall Illumination—Winnipeg

lamps will be pushed farther and farther out on the outskirts until finally they are entirely replaced. The decorative type of street fixture has taken a very strong hold on the citizens and in all of the better streets they are petitioning for these lamps. A number of different standards are being tried out, but the choice seems to have finally narrowed down to the new type inverted magnetite 6.6 amp. lamp on a slender column and mounted on both sides of the street about 125 feet apart. The G. M. Gest Company have been awarded the contract for laying about 300,000 duct feet of $3\frac{1}{2}$ -in. Clay Products Company conduits on Osborne, Assiniboine, Smith, Carleton, and Edmonton streets for this ornamental lighting, and which includes a thirty duct run out Portage avenue on both sides of the street to Maryland street, about a mile and a half from the centre of the city.

For intensity and quality of illumination few streets on the continent excel Portage avenue and Main street, where the new lighting work is completed. One can easily read a paper at any place along these streets, and this without the help from the sign and other illuminations.

A contract of considerable interest in connection with this subject is that recently let to the Mitchell Gray Electric Company for the interior and exterior illumination of the Street Railway Chambers, now building and which is of still further interest as being the largest contract of the kind awarded in Winnipeg, being for \$31,000. It is said that the exterior illumination of this building will be the most effective of any office building on the continent.

Work has commenced on the installation of piping which will contain the cables in connection with the new three-globe tungsten lighting system at Nelson, B.C. It is planned to install an ornamental lighting system on all the principal streets of the city.

The Installation of High-Tension Submarine Cables at Fort William, Ontario

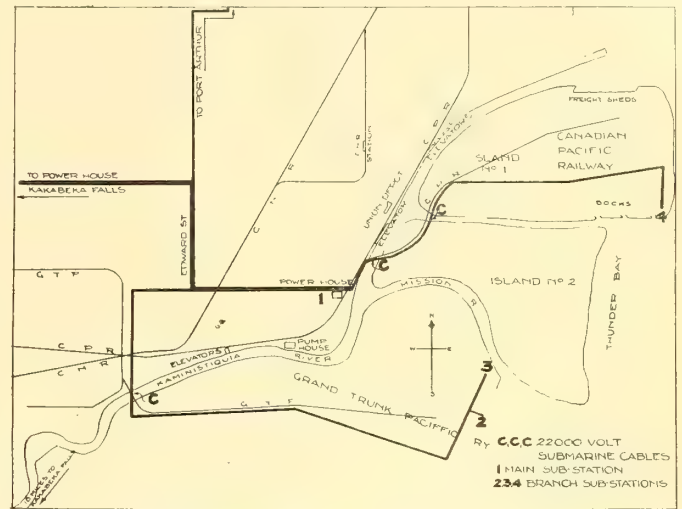
By Mr. W. J. Hoover*

When the generating plant and main substation of The Kaministiquia Power Company, Limited, were put into operation in 1906, there was no immediate intention on the part of the management of using the 25,000-volt transmission lines connecting the two stations for any purpose other than conveying power to the distributing busses in the city, with possibly a branch line to the city of Port Arthur. Before long, however, the location of large industries in the territory surrounding the city made it imperative that the company should deliver large blocks of power at distances too great for the economical use of the secondary pressure of the main station, namely 2400 volts. This is perhaps but a repetition of the history of most of the larger operating companies, and it would hold out little interest from an engineering standpoint, had it not been for difficulties peculiar to the district, met in working out the solution of this particular company's problems. Of these, the greatest was the river.

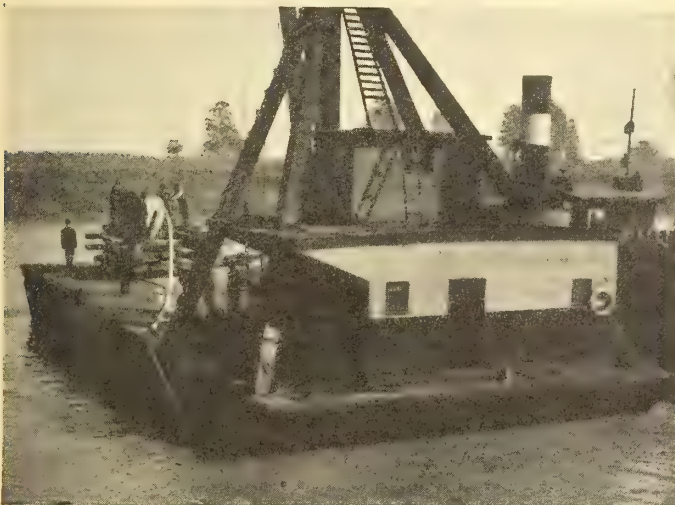
The Kaministiquia river,—the one greatest asset of the city, and the "raison d'être" of the company's existence,—has, like most great people and things, an aggravating habit of sometimes getting in the way. The main stream itself is about five hundred feet in width, and is navigable for lake vessels for a distance of nearly seven miles from its mouth. In addition to that, the river has been gratuitously supplied by Nature with two additional mouths, known locally as the Mission and McKellar rivers, which connect the main channel to Thunder Bay by shorter routes, and incidentally add several miles to the available water-frontage of the harbor. These branch outlets, though not originally navigable for lake craft, have been dredged by the Government to the

greatest development will take place. These conditions, requiring as they do, a river crossing of moderate cost combined with high reliability, finally resolved the problem into the selection of the proper cable for the work and usage it would be subjected to.

The cable chosen was one manufactured by the British Insulated and Helsby Cables of Prescott, Lancashire. It is a three-conductor, spirally laid, paper-insulated, lead-sheathed



Transmission lines, sub-stations and submarine cables supplying Fort William.



Cable laying by use of scow and tug

same depth and width as the main channel, forming, as a result, two large islands, each several square miles in area—an ideal place truly for the location of mammoth grain elevators, coal docks, ore docks, factories, freight sheds, and warehouses, in fact, any industry which a combination of rail and water transportation facilities would benefit.

But navigable rivers are troublesome propositions to a distributing station. Government regulations all but prohibit overhead crossings, and the volume of business at present obtainable would not warrant tunnelling underneath; besides, no one knows—no one can know—just where the

cable, protected by a double armour of steel wires, over which is laid a covering of jute. The over-all diameter is four inches, and the weight is twenty-two pounds per foot.

One of these cables was installed in October, 1909, to serve industries located on the mainland south of the river. Advantage was taken, in this case, of the protection afforded by a swing bridge built by the G. T. P. Ry. Co., and the cable was laid close to the bridge-piers, emerging from the river on the opposite side of the bridge to that of its starting point. All of the work of installing that cable was done by hand. A three-quarter inch steel messenger was strung from side to side of the river, and bulkheads set, to serve as snubs for it when all other preparations were completed. A number of ordinary hanger pulleys were strung on this messenger, and as the cable was pulled off the drum, pulleys were attached to it every fifteen feet of its entire length. A leader line, attached to the end of the power cable, was strung across the river to a hand-winch, and when all was ready, during a lull in the river traffic, the messenger cable was pulled taut, snubbed to the bulkheads, and the power cable was started on its journey. When sufficient cable had been taken across, the messenger was slacked away, and cable, pulleys, and messenger all lowered together to the river-bottom. The actual work of laying the cable occupied a gang of twelve men for five hours.

A second cable was laid across the river in August, 1912, at a point two miles below the previous installation, connecting the upper, or No. 2 island to the transmission system on the mainland. The laying of this cable was accomplished by the use of a large derrick-scow and tug. The reel being mounted on the scow, one end of the cable was snubbed to shore, and the cable paid out over the side of the scow as the outfit was towed across the river. The time required for the actual laying of the cable in this case was but three minutes, from shore to shore.

Both cables are giving satisfactory service under an operating pressure of twenty-two thousand volts, and withstood a high-potential test of upwards of thirty thousand volts immediately after installation.

* Line Superintendent Kaministiquia Power Company.

Preparations are now under way for the laying of a third cable, this one spanning the McKellar river, and connecting the two islands. It is intended to handle it after somewhat the same fashion as the second cable.

The only protection given these cables after laying is the mounting of large illuminated "Danger" signs on either shore, warning skippers and pilots against dragging anchors, and stating the voltage of the line. Only one case of trouble from this cause has been registered so far, and that one occurred within a month after the first cable was installed. No serious damage was done to the cable, and it was immediately put back into service. The cables have successfully withstood electrical stresses due to short-circuits, and have proved a very satisfactory means of submarine transmission, and quite as rugged and reliable as the most exacting operating conditions could demand. The accompanying cut is self-explanatory, and indicates the method adopted in the work described above. The map shows the location of the transmission lines, the sub-stations and the submarine cables.

Saskatoon

The city council are advertising for an experienced man to take charge of the new street railway system under Mr. Sangster the superintendent of light and power. The twelve single-truck cars for the street railway have been shipped and will probably arrive before the end of the month. Two motor-generator sets have been ordered but are not yet delivered. The latest report is that the street railway system will be in operation by the middle of December.

Electrical contractors throughout the city are experiencing a shortage of material. Wire and pipe seem to be the principal things of which a scarcity is noticeable. The city is installing an electric police call system at the present time.

The town of Sutherland, two miles from Saskatoon, is considering the installation of an electric light and power plant to be owned and operated by the municipality. This town is also asking that the Saskatoon street railway be extended out to them and they offer to lay the rails themselves.

The city have passed a new rule to the effect that all services for large buildings must be made underground, the main switches and cut-outs to be located in the basement. There have been a number of apartment houses erected this summer which are equipped with all the modern electrical contrivances, noticeable among which is the electric stove, for which the city gives a special rate of 6c per kw. hour. The city council have passed a number of by-laws referring to electrical installations, requiring metal conduits for all lighting installations in the first class fire districts, metal moulding instead of wood moulding, &c.

The superintendent has presented the following estimate of material required for extensions for the year 1913: 2000 meters, 40-40 kw. transformers, 40-30 kw. transformers, 50-20 kw. transformers, 50-15 kw. transformers, 10-50 kw. transformers; 225,000 lbs. of wire; 1200-35 ft. poles, 600-40 ft. poles, 100-45 ft. poles, 100-50 ft. poles; cross arms, pins, insulators, hardware, one motor service wagon. These estimates are calculated to cost \$150,000.

Calgary

The city of Calgary are making extensive additions to their arc-lighting system. The question has not been definitely decided yet as to whether ornamental standards with incandescent tungstens will be used on the main streets, and a number of these are being put up for inspection and tests. Superintendent R. A. Brown is quoted as favoring the arc-lamps on account of their much greater efficiency.

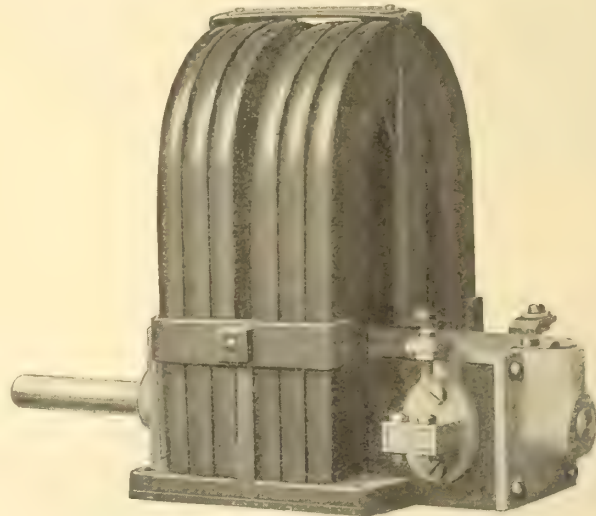
Brandon

Good progress has been made in the laying of the rails for the Municipal Street Railway System and it is hoped that the cars will be in operation by May 1, 1913. A recent report states that the track work is practically finished with the exception of a crossing over the C. N. R. and that the wooden poles to support the trolley wires are all placed. Along the main streets iron poles will be used but are not yet installed. It is understood that the order has not yet been placed for the rolling stock and that it has not been decided just how the power will be obtained.

Electric Speed Indicator

The desirability of knowing the speed of vehicle, machinery or shafting at any time is something that is now so generally required in every branch of industrial work that a variety of instruments for this purpose have been brought out from time to time. The use, however, of the majority of these indicators is limited to a particular class of apparatus and hence not practicable for use on different applications. For such a universal application the electric indicator, illustrated herewith, is especially adapted.

The electric speed indicator consists of a magneto-generator and a direct-current measuring instrument. The mag-



neto is attached to a pulley or shaft of the apparatus, the speed of which is to be measured, and since the voltage of the magneto-generator is proportional to its speed, the meter which is properly calibrated indicates the speed directly at any time. When operating at 1,000 revolutions per minute, the magneto generates 25 volts so that the meter may be calibrated for any unit, as revolutions per minute, cycles per second, percentage fast or slow or feet per minute. On account of the ease with which these indicators may be adapted to the many types of machinery, they find a wide field of application. The meter may be mounted some little distance from the indicator so that it is possible to place a number of the meters in one place, making it possible for those in charge to note the efficiency of the work in the various departments at any time. A comparatively new use of speed indicator is for determining the speed of trains or electric cars. The indicator may be attached to the axle and, if the meter is adjusted to prevent jar, this will give excellent results. The indicator is small and can be placed anywhere near the machine, the overall dimensions being only 6 x 10 x 10 inches and a variety of meters may be used with it. The magneto-generator which is manufactured by the Holtzer-Cabot Electric Co., is especially designed for use with meters manufactured by the Westinghouse Electric & Manufacturing Company.

A Page of Miscellaneous Cost Data

Stringing Mile of Telephone Line

Stringing one mile of telephone line composed of two No. 10 T. B. W. P. iron wires, through porcelain knobs on 5/16 in. span wires.

1 foreman, 9 hrs. at \$2.66	2.66
2 linemen, 18 hrs. at \$2.50	5.00
1 groundman, 9 hrs. at \$1.75	1.75
1 team, 9 hrs. at \$4.00	4.00

Total ... \$13.41

Unloading Carload Cedar Poles

Unloading a Gondola carload of 124 cedar poles, composed of 8-7½ in. x 35 ft.; 50-5 in. x 20 ft.; 56-7 in. x 30 ft.; 10-7 in. x 35 ft.; time 4½ hours.

1 foreman at \$80.00 per month	1.33
2 linemen at \$.27 7/9 per hour	2.50
2 groundmen at \$.19 4/9 per hour	1.75
1 team at \$40 per hour	2.00

Total ... \$ 7.58

Cost per pole ... \$.0611

Note 1—The \$4.00 rate for team, included the driver and horses. The driver materially assisted in the work, the horses were used very little, but as the team was hired as part of the line force, the total expense (team and man) was included in the cost.

Note 2—Weight of 6 in. x 30 ft. cedar pole = 350 lbs.; weight of 7 in. x 30 ft. cedar pole = 450 lbs.; 160-6 in. x 30 ft. cedar poles make a car load.

Digging Out Poles

Digging out ten 6 in. top, 25 ft. and 30 ft. cedar poles; time used one day. Condition of ground, clay and some quicksand. Poles set 5 ft. in ground.

1 foreman	2.66
1 lineman	2.50
1 groundman	1.75
1 team	4.00

Total... \$10.91

Cost per pole = 1.091.

Digging Holes for Poles

Hole for a 5 in. x 20 ft. telephone pole in gravel, per pole	\$.57
Add \$.07 for board of men	.07

\$.64

Hole for 5 ft. x 20 ft. telephone pole in clay, per pole	.546
Add \$.07 for board of men	.07

\$.553

Hole for 7 in. x 30 ft. trolley pole in sandy soil. \$.677

Applying Carbolineum Avenarius

The first coat was applied for a distance of 7 feet from the butt, on the butt and top. The second coat was applied from a point 5 feet from the butt to a point 7 feet from the butt. Both coats applied hot.

31-5 in. x 20 ft. cedar telephone poles used 1 gallon of preservative at \$.70, for first coat.

Cost including gasoline used to heat preservative, per pole ... \$.0427
31-5 in. x 20 ft. cedar telephone poles used ½ gallon of preservative at \$.70 for second coat. Cost including gasoline used to heat preservative, per pole ... \$.016

Mile of Telephone Line

Cost of stringing 1 mile of a telephone line composed of two No. 10 galvanized iron wires on Pony glass insulators, mounted on 1 in. oak brackets, the brackets held to pole by two No. 30 nails. This line was at an average height of 11 ft. except at farm and highway crossings where the height was made 15 ft. and over.

Labor in installing brackets, glass and tying in wire at \$15.81 per mile	\$15.81
80 brackets at .016	1.28
80 Pony glass insulators at .017	1.36
160 No. 30 nails, 25 to the lb. at .025 per lb.	.16
Tie wire	.25
Two miles of No. 10 D.G. iron wire at .04 per lb.; 225 lb. at \$10.20 per mile	20.40

\$39.26

Setting Poles

Setting 21-5 in. x 20 ft. cedar poles. Foreman, 7 hours; linemen, 14 hours; groundmen, 4 hours; team, 4 hours.

Total cost	\$9.30
Cost per pole	.443

Setting 21-6 in x 30 ft. cedar poles. Foreman, 12 hours; linemen, 11 hours; groundmen, 47 hours.

Total cost	\$15.71
Cost per pole	.705

Setting 2-7½ in. x 35 ft. cedar poles

Total cost	\$2.18
Cost per pole	1.09

Telephone Construction

Total cost to string one mile of telephone wire, composed of two No. 10 D. B. W. P. iron wires, through centre groove porcelain knobs tied to 5/16-in. span wire.

Labor in putting on knobs, 106 knobs at .109 per knob. \$11.55
Labor in stringing wire through knobs at \$13.41 per mile ... 13.41

Cost of two miles of No. 10 D. B. W. P. iron wire at \$33.00 per mile ... 66.00

Cost of 106 knobs at .0216 ... 2.29
Tie wire45

Cutting in five transpositions, or one transposition every ten poles at 100 feet spacing of poles .. 6.99

Total ... \$100.69

Bracket Installation

Labor installing 35-10 ft. flexible pole brackets; brackets already fitted with span wire and hole already bored in pole for brace-rod.

35 brackets at 37 cents each .. \$12.95

The Ottawa Electric Railway Company has adopted the plan of stopping its cars on the near side of streets.

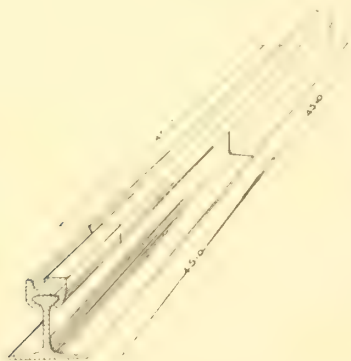
ELECTRIC RAILWAYS

The Continuous Rail

One of the most interesting features connected with the Convention of the American Electric Railway Engineering Association at Chicago, was the reading of a paper by Mr. R. F. Kelker, Jr., principal assistant engineer to the Board of Supervising Engineers, Chicago Traction, in relation to the continuous rail laid in the city of Chicago last year. The steam machine brought over from England last year to lay this rail was on exhibition, as well as sections of the rail which it had rolled; and in the streets of Chicago, the Continuous Rail Company had in operation a new electrically driven machine, which was an object of great interest to the visiting engineers..

Mr. Kelker quoted in his paper figures from a report of Mr. Ralph Rice, division engineer, Board of Supervising Engineers, Chicago Traction, and Mr. A. A. Thurlby, superintendent of wires and cables, Chicago City Railway Company. Tests made by them upon the track laid in South Halsted street showed that the continuous rail was of much greater electrical conductivity than the standard rail used there. The increased conductivity in the continuous rail was found to be equivalent to more than one inch of copper, giving a saving in the negative return amounting to about \$8,000 per mile of single track. There is a further saving of all mechanical joints or electrical bonding of the rail, which would amount to not less than \$1,000 per mile of single track.

When the continuous rail is worn out it is only necessary to remove the paving blocks and renew the head sec-

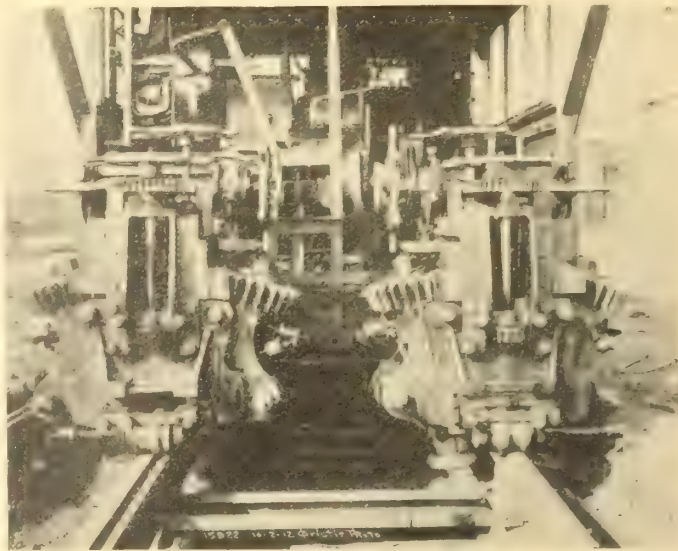


View in perspective of Continuous Rail

tion, effecting a saving in reconstruction of about \$6,000 per mile in labor and concrete, plus about \$3,000 per mile in ties, tie rods, tie plates and screw spikes. By reason of the staggered joints between the upper and lower section of the continuous rail, all joint troubles are eliminated and sixty per cent. of the cost of track maintenance is saved, while interruption of traffic for repairs is minimized. Where track conditions are excessively severe and the cost of labor and material high, as for example, in Broadway, New York, the saving in renewals by the use of continuous rails would amount to over \$15,000 per mile of single track, and the saving in maintenance charges to over \$2,000 a year per mile. The economy effected by the use of the continuous rail is, therefore, not confined to the saving of the lower half when the head is worn out, but includes the greater part of the cost of labor and material used in ordinary reconstruction, and over one-half of the cost of maintaining the track in running condition.

We give a photograph showing the mechanism of the

installing machine in working position on a section of track which has just been completed on the north side of West 17th Street in Chicago, and another photograph showing a



Installing machine at work

sectional view in perspective of the rail. Note the staggered joints between the upper and lower sections which guarantee increased conductivity.

M. & S. C. Extensions

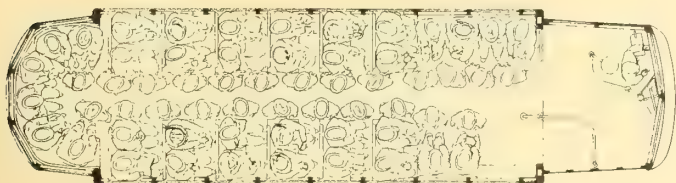
About fifty miles of new track are under construction by the Montreal & Southern Counties Railway, and it was expected that the cars would be running on the extension to Richelieu by the end of November. The old Central Vermont line has been utilized for this extension, heavy steel rails being laid, and two miles of new road constructed. A steel bridge has been built over the river to Chambly. The main distributing station is at St. Lambert, with one substation at Chambly Basin. Next year it is hoped to further extend the line from Richelieu to Granby, and two substations will be erected. Eight cars have been ordered from the Ottawa Car Company for the Richelieu service. After repeated applications the Montreal Council have granted permission to the company to extend their tracks from the Montreal terminus on Youville street, so as to get connection with the Grand Trunk Railway, and also with the street railway at Wellington and McGill streets; further, to extend the line across McGill street to the south side of Youville Square.

Fort George Power Co.

The Fort George Power Company, B.C., recently applied to the provincial government for a license to store 121,600 acre feet of water from Willow River, to be stored in a reservoir at Stony Lake, Stephens Lake, and connecting waterways; 192,000 acre feet of water to be stored in a reservoir at Petonie; 89,600 acre feet to be stored at St. Mary's Lake, Frances' Lake, St. Joseph Lake and connecting waterways; 14,400 acre feet to be stored at Jack of Clubs Lake and 52,000 acre feet to be stored at Narrow Lake. The water is to be used for power purposes.

One-man Prepayment Cars

A type of car which appears to have much to commend it for operation in towns or smaller cities is being tried out in Lockport, N.Y., where twelve, one-man, near-side, prepayment cars have been constructed by the J. G. Brill Company for the International Railway Company of that city. The accompanying cut gives a view of the car floor showing entrance and exit, seating capacity for 36, and standing capacity for 24. This car is 30 ft. 7½ in. over all with front platform 5 ft. 6 in. and rear platform 4 ft. From track to

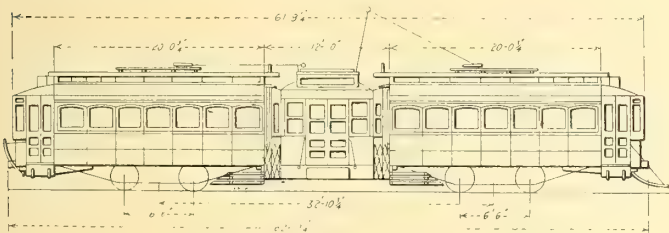


One-man prepayment type of car

first step is 13 in. and from step to platform 12 in. The car is supplied with a single Brill No. 21E truck, 8 ft. wheel base, wheel diameter 31 in. Operation is by two 50 h.p. motors. The total weight of the car is 22,620 lbs., making the weight per seated passenger 628 lbs.

The Articulated Car

Another new and very unusual type of car has just been placed in operation by the Boston Elevated Railway Company, and is described in a current issue of the Electric Railway Journal. This car is known as the Boston articulated car, and is made up of two old single-truck cars which are flexibly connected together to a common central vestibule in much the same way as two steam railway cars are nowadays connected. The car consists, therefore, of three compartments, the two end sections being 20 ft. cars with one vestibule and platform removed from each. The intermediate compartment affords a flexible connection between the two ends and is used only for entrance and exit purposes, the seating space being entirely confined in the two end portions. This type of car is specially adapted to sharp curves and it is said that no difficulty is experienced in operating on curves of even 35 ft. radius.



Made up two single truck cars

The middle compartment is 12 ft. 10 in. in length and is pivoted to the end compartments in such a manner as to provide at all times a safe and easy passage between the compartments. There is no truck under the centre compartment which enables it being carried closer to the ground and permits a low step of 14 in. In this way the centre compartment provides all the valuable features of the centre entrance type of car and enables the prepayment feature to be utilized to advantage. The conductor stands near the middle of the centre compartment. Passengers leave by the front end or by the middle compartment doors, and at terminals where platform attendance is available, the rear door is unlocked for exit purposes. Though not ordinarily practised, a third man can be placed upon the rear platform in times of extraordinarily heavy traffic. The seating capacity is 52. A sectional drawing of the car is shown herewith,

Another Gasoline-Electric Car

The cut shown herewith illustrates one of six gasoline-electric railway motor cars installed on the Missouri, Oklahoma and Gulf Railway. This type of car has been used with success on the Arad-Csanad railway in Hungary for the past seven years where the regular runs are over distances up to 50 miles. For this distance the schedule time is 2 hours and 15 minutes.

The M. O. & G. Railway car is 56 feet in length over bumpers; width over all 9 feet 6 inches. The car is divided into four compartments for engine equipment, baggage, colored and first class. The trucks are M. C. B. standard. The forward or driving truck carries two 60 h.p. traction motors. The total weight of the car is 65,000 lbs. The passenger capacity is 44. The cars are to be lighted by means of 30 volt metal lamps fed by storage battery and the head lights are electric-arc type.

The power equipment consists of a gasoline engine



A gasoline-electric in use on the M.O. & G. Ry.

direct-connected to an electric generator. The engine is rated at 90 h.p. at 950 r.p.m. with six cylinders, 140 x 160 mm., cast in pairs. The engine is connected by flexible coupling to a 55 kw. 500-600 volt interpole generator. A special steel base combines these two units. The engine room requires but 7 feet 3 inches of the car's length. The motors are Westinghouse No. 305 interpole type, geared for a maximum speed of 35 miles per hour. Duplicate controller equipment is supplied that the car may be operated from either end. The St. Louis Car Co. built these car bodies and trucks from designs of the Drake Railway Automotrice Co. of Chicago and Paris.

The Gerrard Street Car Lines, Toronto

Four cars are being purchased from the Preston Car & Coach Company for service on this line. These cars are 8 ft. 6 in. wide, 11 ft. 10 in. from top of rail to top of car, and 46 ft. long with double end control. The cars have a centre aisle and are semi-convertible, i.e., the windows push up into the roof. There will also be a sweeper as part of the equipment. The city are at present building a car barn 96 ft. by 30 ft., and stringing 350,000 c.m. 73-strand feeder cable from the pumping station on Gerrard street over the whole length of the line, which is 1.85 miles. The trolley wire is hard drawn copper, 90 per cent. pure, No. 2/0. The steepest grade of the line is 3.1 per cent. The devil strip is 5 ft. 4 in. The bonding is at present being proceeded with, type EA5 bonds, manufactured by the Electrical Improvement Company, of Cleveland, Ohio, being used. This bond is 8½ in. long, 25 laminations with 4/0 capacity. The delivery of the special track work will not be made until the end of December, meanwhile 45 lb. construction track steel is being used. In the power house will be installed a 300 kw. rotary converter, to convert from 2200 volts a.c. to 600 volts d.c., together with a 300 kw. direct-connected engine, so that in the event of hydro power failing, steam will be held in reserve.

The Lake Erie and Northern Railway Co.

The Lake Erie and Northern Railway Co. have recently closed a contract with Messrs. Johnson Bros., of Port Hope, covering 53 miles of line from Port Dover through Simcoe, Brantford and Paris to Galt, connecting at this point with the main line of the C. P. R. The contract embraces grading, track-laying and masonry, the work to be completed by December 1st, 1913. The entire line will be of standard steam road construction, 80 lbs. steel rail being installed throughout. All bridge structures will be permanent. The management are considering the electrification of the entire line but the type of electrical system has not yet been decided upon as it is the intention of the directors to consider thoroughly the merits of both a.c. and d.c. operation. In Port Dover, Simcoe, Brantford, Paris and Galt, industrial spurs will be built to serve the principal manufacturing establishments in these towns. The general manager of the company is Mr. W. P. Kellett.

The National Brake Company

During the last two or three years the attention of railway officials and public service commissions has been particularly directed to brake equipment on account of frequent accidents. Not but that many accidents happen which are in no way chargeable to equipment, but there are some which are the result, either directly or indirectly, to failure on the part of the braking equipment.

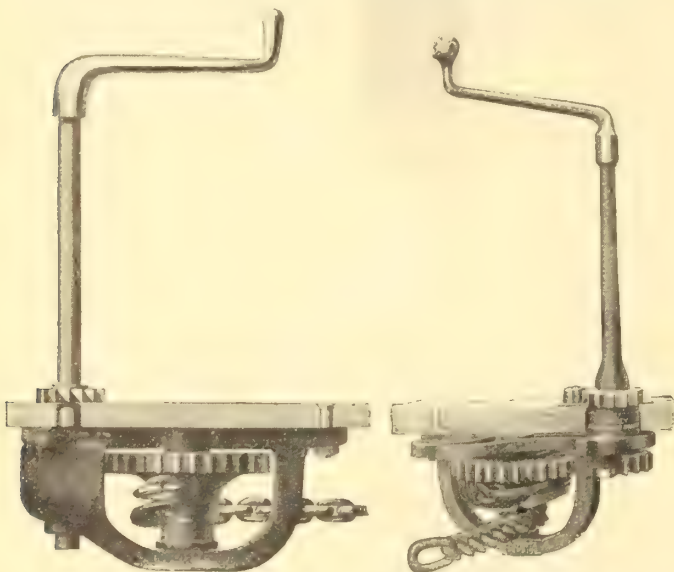
Braking equipment is roughly divided into power brakes and hand brakes and no one will question the value of the

and designs of brake have been developed so that hand equipments are now being furnished which will afford braking power equal to one hundred per cent. of the weight of the car and with very little expenditure of energy on the part of the motorman. In cases of emergency the motorman is thus able to double or treble the braking power so that even with heavily loaded cars he can exert a power on the brakes equal to the full weight of the car and the load combined. Recent tests on heavily loaded cars equipped with this system of hand brakes have shown this to be one of the most valuable features of this style of equipment.

Railway Condulets

One department of electrical wiring which has been largely neglected by the manufacturers of electrical appliances is that of the railway field. Here the electrician has been compelled to devise ways and means of his own to effect the desired result, and in only a few instances have appliances been at hand especially designed to aid him in his work.

Answering the demand of car builders and railway electrical engineers, the Crouse-Hinds Company of Canada, Limited, have now perfected and placed upon the market a complete line of condulets. These new designs include types for use in railway coaches, shops, roundhouses and yards, and seem to satisfy the demands. Condulets designed for coaches include types for all sorts of fittings and fixtures for any location, whether it be on deck sill, ceiling or side of car. There are also types for junction boxes, for telephone jacks, for battery charging equipments, including plug and receptacle, for 100 to 200 ampere fuses for battery circuits and for connecting and disconnecting wires leading from the dynamo to the regulator in the car. Many of the designs referred to above can also be used to advantage in shops and roundhouses. Among other condulets in this new series, the most notable is the yard charging equipment which provides for both surface and underground conduit installation. Special 100 ampere receptacles and plugs are provided for this fitting, though other standard receptacles can be used if desired. All condulets that are intended for use in exposed locations are thoroughly waterproof and designed to withstand hard usage. Complete illustrations, descriptions and listings are given in Condulet Bulletin No. 101, just issued.



The Peacock Brake

The Ackley Adjustable Brake

former. Transportation could not be what it is to-day without them. Yet strange as it may seem their very efficiency is often one of the most general causes of accidents. Particularly is this true of that class of accidents where cars collide with other vehicles and where the collisions are often due to miscalculation on the part of the motorman of the distance required to bring his car to rest. Practice and caution should eliminate many of these accidents but cannot do so entirely, even with experienced motormen. It is also true that the governors, compressors and other devices which are essential parts of a power brake equipment are subject to many disorders, any one of which may render the brake inoperative at the critical moment. Knowledge of these facts has led to the investigation of the merits of the hand brake at least as an auxiliary of the other. Among the companies which have kept pace with this agitation is the National Brake Company of Buffalo, manufacturers of the Peacock & Ackley adjustable brakes. Many new sizes

On Thursday, the 31st day of October, the death of Mr. A. Lichtenhein occurred at his home in New Rochelle, N.Y. Mr. Lichtenhein was president of the Galena-Signal Oil Co. and was well known to railway men throughout Canada, who will deeply regret his loss.

The British Columbia Electric Railway Company have recently placed an order with the Westinghouse Company for five fifty-ton locomotives to be equipped with four No. 308B-3 motors and HB control.

Stewart, B. C.

A new lighting schedule was recently put into force at Stewart, B.C., by the Stewart Portland Canal Light, Water & Power Company. According to manager W. R. Smith, the company has suffered heavy financial loss since starting operations, and it is proposed to cut the time of operating down to nine hours, instead of the present all night lighting service. In consideration of the reduced service the company also proposes to make an additional 10 per cent. reduction in current charges. The nine-hour light service will start at dusk, according to the season of the year. In mid-winter it would commence at 3 p.m., and the power be then cut off at 12 p.m.

A New Process for the Protection and Preservation of Standing Telegraph and Telephone Poles

By E. A. Sterling

Modern methods of transportation and communication have caused such a drain on the timber resources of the country that high prices and an ultimate exhaustion of certain species grades will be the inevitable result. The use of wood is universal everywhere, but nowhere is it more strikingly shown than in the enormous number of poles which dot the landscape everywhere, their most general use being for telegraph, telephone, trolley, and electric transmission lines.

Cedar furnished the material for about sixty-five per cent. of the poles renewed in 1910. A report of the National Electric Light Association states that thirty-foot cedar poles lasting fourteen years have taken about 190 years to reach that size, thus it would require thirteen growing cedars to continue in service one thirty-foot cedar pole. To maintain one thirty-foot chestnut pole, even in a healthy growth unaffected by the blight, would require four growing trees. These facts indicate clearly the necessity of preserving the poles now in use as well as those used for current renewals.

The available statistics indicate an average life per pole of from $13\frac{1}{2}$ years for cedars to $6\frac{1}{2}$ years for pine; the general average based on present renewals being about ten years. A report of the German government shows an average life of only 7.7 years on 153,626 untreated poles under observation. Until recently practically all poles in this country were used in their natural state, and great waste has been occasioned by their rapid decay where in contact with the ground. The U. S. Forest Service estimates that 95 per cent. of poles are destroyed by decay, 4 per cent. by insects, and 1 per cent. by mechanical abrasion. In 1910, 825,000, or nearly 25 per cent., received preservative treatment either before or after purchase, and this should lengthen their life from 50 to 100 per cent. While the treatment of a pole before it is set is advantageous, it adds very materially to the initial cost and will not check the increasing consumption until a greater per cent. are treated, or until the majority now in place have been removed. A more immediate saving, and one which would save the cost of the poles as well as the expense of resetting them, would be a treatment which could be applied successfully to the millions of poles now in place.

The conditions under which poles are used vary so greatly that an average cost figure for pole renewals is difficult to determine. Generally speaking, the cost may vary from \$1 to \$2 per pole for country telephone lines to \$100 or more for the high poles in city streets. The initial cost of the pole varies from \$1.80 for a 25-foot cedar pole to \$16.21 for a 60-foot pole of the same, or \$17.08 for a chestnut pole of the same length, to which must be added the labor of setting, restringing wires, accessories, etc. A fair average for a commercial line along railroads or through country districts, with three to five cross-arms, would be about \$10 per pole, including all items. This would mean that the poles now in use in the country represent a value of \$320,000,000, and that the annual renewals cost in the neighborhood of \$40,000,000.

Practically all poles fail at the ground line because of decay, and on account of this weakening at the base have to be replaced or cut off and reset, while the top portion is still sound. This decay is caused by wood-destroying fungi which have a definite origin and develop under the same fixed laws of growth that govern the higher forms of vegetable life. Fungus growth has its origin in microscopic spores which are comparable to the seeds of plants, and as they are present nearly everywhere, it merely remains for them to

find favorable conditions under which to germinate and develop the microscopic threads which permeate the tissue of the wood and destroy its texture. The fundamental factors necessary for the growth of fungi are moisture, air, and a certain degree of warmth.

These conditions are found in favorable combination at the ground line of poles, where the moisture from the earth keeps the surface of the wood moist, and where, just underneath the surface, the soil maintains, except during the winter season, a sufficient degree of warmth for the fungi to develop. It follows, therefore, that the decay of poles appears from a few inches above the ground line to a distance of a foot or more beneath, the air being more or less excluded at the basal portion of a pole; while above the ground line, under ordinary conditions, insufficient moisture is present for the rapid development of decay.

What is now known as the Lamb pole treatment first renders innocuous the decay which has already started, and then seals the ground line portion of the pole with an impervious preservative coating, which prevents the evaporation of the preservative previously applied and prevents further decay by entirely eliminating air and moisture.

The whole process is simple and inexpensive, and consists of first removing the dirt around the base of the pole to a depth of two to two and a half feet, and scraping or cutting off the decayed portions of the wood. A hot brush treatment of coal tar creosote is then applied liberally, which kills the living organisms of decay and penetrates the outer tissues of the wood. A fireproof casing is then placed around the pole, the upper portion extending about six inches above the ground line and the lower portion from eighteen inches to two feet below, making a total length of from two to two and one-half feet. This casing is held out from the pole by spacing rods which leave about a half inch opening between the pole and the casing at the solid portions and a greater space where decay has existed.

After the casing is in place, the dirt is tamped in at the bottom up to the base of the casing, and inside of the form is poured a hot preparation of pitch which will yield a distillate of high boiling and high gravity creosote oil. The pitch, after it hardens, will form a perfect bond with the creosoted surface of the wood and entirely prevent the entrance of air, moisture, or other agencies favorable to decay, and at the same time prevent the evaporation of the creosote which was applied by brush treatment to the decayed surface. The creosote in the pitch acts as an additional toxic agent in destroying and preventing all forms of decay. Experiments have shown that this pitch filler will not only form a perfect bond with the wood and remain in absolutely close contact in all climatic changes, but it also entirely fills all surface checks and, to a slight degree, penetrates the wood. After the pitch has been poured in and has cooled, the dirt is thrown back around the pole and tamped tight and a protective fireproof covering or cap of cement is applied; or, if the filler is poured to within only about two inches of the top, the edges of the fireproof casing can be bent over and tacked to the pole, thus eliminating the use of a cement cap.

The cost of the Lamb pole protective treatment is but a fraction of the cost of putting in a new pole, and under average conditions one year's increase in the life of a pole will pay for the treatment. The average pole has a life of about ten years, and the cost of replacement is averaged at \$10, hence the annual charge on a four per cent. compound interest basis amounts to about \$1.25 per pole. If properly treated at the ground line a conservative estimate places the increase in life at from 5 to 10 years. To double the life of poles would mean a saving of 2,000,000 poles per year, which is equivalent to the pole timber on at least 25,000 acres of heavily stocked forest.

Industrial Progress and Trade Notes

Trade Publications

Economy.—A booklet issued by the Neptune Meter Co., 90 West Street, New York, descriptive of Trident water meters.

Bushings.—An illustrated pamphlet published by the Federal Sign System of Chicago, descriptive of "Federal" lock, clamp, bushings.

Rubber Insulated Wire.—A publication issued by the Standard Underground Cable Company, of Hamilton, descriptive of Sterling rubber insulated wire and cable.

Colored lamp hoods.—Bulletin and price list No. 22, issued by the Reynolds Electric Flasher Manufacturing Company, descriptive of colored lamp hoods for electric signs, displays and out-door decorations.

The Dracar.—Booklet issued by the Drake Railway Automotrice Co. of Chicago, and Paris, describing the "Dracar," a self-contained, self-propelled passenger car. This is another type of gasoline electric railway car that is meeting with favor in the United States.

Car-brake Operation.—A booklet issued by the Scientific Railway Appliance Company, descriptive of car-brake operation and manipulation as applied to straight air-brake cars. The booklet is very fully illustrated and the construction and operation of this equipment is fully described.

The Lyhne Lamp.—A sheet published by Irving Smith, Montreal, sole agent in Canada for this lamp. It is claimed that this is a scientific universal utility lamp which is instantly adjustable to any angle, and saves ninety per cent. of the eye strain by confining the light to the space to be illuminated.

De Laval Steam Turbines.—A 120 page descriptive catalogue, issued by the De Laval Steam Turbine Company, of Trenton, N.J., descriptive of the multi-stage type of De Laval steam turbine. The catalogue is splendidly illustrated and contains very complete information on the construction and operation of the various parts of this type of apparatus.

High voltage equipment.—Bulletin No. 8, issued by the Railway and Industrial Engineering Company, describing their manufactures of high voltage air-break switches and improved horn-type lightning arresters and fuses. The pamphlet is well illustrated and a list of a number of users both in Canada and the United States is added.

O-B Bulletin.—issued by the Ohio Brass Co., of Mansfield, Ohio, periodically. The present issue contains interesting information on O-B equipment used on a number of large power propositions, including the Mississippi River power development at Koekuk, and the 1500 volt d.c. development on the Piedmont and Northern lines.

Facts.—Booklet issued by the American Engineering Company, Philadelphia, concerning the operation of Taylor stokers. The booklet contains a series of boiler tests in which Taylor automatic stokers figured, and gives interesting information about the work of the stokers in various plants where they have been installed.

Electrical Fittings.—Catalogue No. 4, issued by the Electrical Fittings Company, Limited, of Toronto, manufacturers of electrical fittings and specialties; factory at Guelph, Ont. The catalogue is well illustrated and contains an unusual amount of useful information. Among other things figures are given indicating the sizes of conduits to be used with different numbers of wires of different sizes.

Inter-phones.—A booklet descriptive of their "Inter-phone" apparatus has been issued by the Northern Electric and Manufacturing Company, Limited, Montreal. This is the company's trade name for what is generally known as inter-communicating telephone apparatus. The booklet is illustrated, and gives particulars of the various systems for which inter-phones are adapted. A complete connection diagram is furnished with each inter-phone. The same company have issued a pamphlet dealing with the Gamewell municipal fire alarm system. These are fully described and illustrated.

Ferranti Electrical Company of Canada

Mr. Geo. C. Royce, Canadian manager of Ferranti Limited, reports that their business has entirely outgrown their old quarters. By December 1st, they will have moved into their new building where they will have more room and better facilities to handle their increased business. Five years ago Mr. Royce took up the Canadian agency for Ferranti Limited, of Manchester, England, and introduced to the Canadian electrical trade the famous Ferranti meter. Business grew rapidly as the goods became known. Later they introduced Ferranti transformers and switch gear and began taking switchboard contracts. They are now doing an extensive business in all these lines and a Canadian company has been formed to carry on the business under the name of Ferranti Electrical Company of Canada Limited, with Mr. Royce as manager. Their new address is No. 90 Sherbourne street.

New Books

Electricity for Everybody.—by R. B. Matthews, A.M.I.C.E., M.I.E.E.; The Electrical Press Ltd., London, Publishers. This hand-book has been written to meet the demand for an authoritative source of information concerning the uses of electricity as supplied by central stations. The author hopes that the volume will assist in popularizing electricity supply, leading to an improved load factor and a greater output among central stations, to increased prosperity for electrical business as a whole, and to an amelioration of the conditions of everyday life by supplying information that will enable the general public to take advantage of the many uses of electricity. The book is divided into four sections as follows: Electric Light; Electric Cooking and Heating; Electric Power; Hints to Canvassers.

The pole lines in America approximate nine hundred thousand miles in length, and the number of poles in actual service is not less than thirty-five million. The annual consumption for renewals and new lines amounts to about four million poles, or nearly five poles per mile per annum. The extent of the drain on the forests which this represents may be judged from the fact that a perfectly stocked German forest produces only 250 trees per acre, so that on this basis the poles now standing would represent all of the timber growing on over 130,000 acres. In this country, considerably less than one hundred poles are cut per acre, so that for the poles now in use forest areas aggregating nearly half a million acres have been cut over, and to furnish the poles for renewals some 50,000 additional acres are cut over each year, or at the rate of over one hundred acres per day.

Universal Bronze

The chemical department of the Escher-Wyss & Company have been experimenting for years upon a new high quality bronze material and have at last succeeded in turning out a substance which possesses qualities, in so far as the strength and elongation of the material goes, not approached by any other metal. The tests show that this bronze is particularly suitable for the construction of runners and impellers of pumps and turbines exposed to the wear and tear of high speed water or impure liquid or acids. The Escher-Wyss & Company are now desirous of getting in touch with parties interested in the purchase of this patent.

The great strength necessary for bronze used in the construction of machinery, the keen competition existing between manufacturers, and the wide fluctuations in the price of tin, have induced metallurgists to study the question of substituting, for the rather expensive tin bronze, some special brass composition (so-called zinc-bronzes), which not only have the advantage of being cheaper, but also surpass the tin bronze in breaking strength and elongation qualities, while at the same time offering the same resistance to attacks by acids. The fact that despite the advantages claimed for zinc bronzes, tin bronze still obstinately keeps its ground in most of the large foundries and in nearly all the minor ones, is unquestionably due to rather serious drawbacks, which even the best zinc bronzes, so far known, present along with their above mentioned remarkable advantages.

The principal drawbacks in zinc-bronze may briefly be summarized as follows,—

(1) Zinc-bronzes generally have a very complex composition containing metals not easily fusible and which unite only with great difficulty. On account of these two features the preparation of the alloy can only be carried out in a very complicated and expensive way.

(2) The zinc-bronzes have a strong tendency toward separating when cooling down in the mould and the so-called "sweating" (liquidation) takes place, which destroys the homogeneity of the smelted metal.

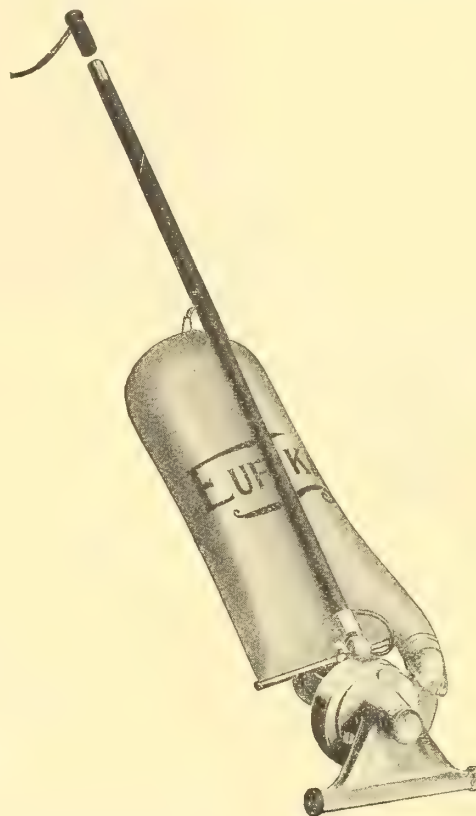
(3) All zinc-bronzes contain iron, manganese or aluminium, and most of the time the compound of these three metals. These additions cause the formation of an oxide scale on the surface of the smelted metal; this scale or pellicle is indestructible and is continually being formed anew even if every precaution is taken in cleaning off the surface. This pellicle may also be carried in the mould, where it is constantly formed afresh; it often gives rise to troubles by intruding into the casting in the form of slag incrustation or superficial impurities.

(4) Perhaps the most important drawback attached to the best zinc bronzes known to date is the fact that they shrink considerably when cooling down, bringing about a tendency to form blows (blow-holes) in the castings.

As already indicated, Escher-Wyss & Company have succeeded in producing a zinc bronze, which they have named "universal bronze," and which possesses a remarkably great breaking strength and tenacity without the disadvantages outlined above. This bronze can be prepared very simply by fusion of the different components, has no tendency to sweating or liquating and only a slight tendency toward shrinking. The surface of the new bronze can be kept perfectly clean before casting, thus avoiding the danger of trouble due to oxides. This company has used the new bronze for some time in the manufacture of many kinds of machinery parts exposed to heavy and sudden stresses and it is found particularly adaptable for turbine pumps where impurities are apt to come in contact with the machinery. Universal bronze may also be forged, rolled, stretched and bent in cold condition.

The Eureka Electric Suction Cleaner

The Onward Manufacturing Company are sole selling agents in Canada for the Eureka suction cleaner, a small but effective electric machine of the carpet sweeper type. The Eureka will operate over hardwood floors, tile floors, linoleum, etc., as well as on carpets and rugs, the nozzle being supplied with wheels, so that it will run on any surface whatever. The rollers on the nozzle raise the machine something less than 1/16 of an inch from the floor, which is claimed to increase the efficiency of the cleaner. These wheels also enable more rapid work and greater ease of



operation in that there is no friction of the nozzle against the floor or floor covering. In addition to this the wear on the carpets and rugs produced by the ordinary friction is entirely done away with. Another item of value is the fact that the new machines of this company are equipped with a self-oiling device whereby the machine requires to be oiled only twice a year.

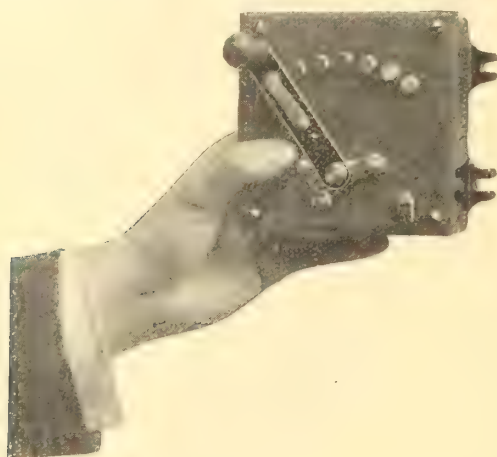
New Telephone Cable

The B. C. Telephone Company has commenced the task of laying the new submarine cable across Burrard Inlet between Vancouver and North Vancouver. The cable, which is three miles in length and weighs 60 tons, arrived in three lengths, each length on a reel. It is an 87 pair, 19 B&S gauge, paper insulated, lead covered, wire armoured, submarine cable, and was supplied by the British Insulated and Helsby Cable Company, London, Eng. The present cables between Vancouver and the North shore are laid under the First Narrows. These are stated to be quite inadequate for the new service which the company are about to inaugurate. This service is the rapid fire or two number system, by means of which a number on either side of the Inlet can be obtained from the ordinary operator without recourse to the long distance call.

Negotiations are proceeding between the Bell Telephone Company and the City Council of London as to the continuance of the company's franchise which expired recently.

Independent Midget Speed Regulator

In order to meet the growing demand for a small, substantial motor speed regulator, the Independent Electric Manufacturing Company, of Milwaukee, have developed a little device termed the Midget speed regulator. This regulator is about $4\frac{1}{2}$ -in. square and intended for the speed regulation of small motors, such as are commonly used on jeweller's lathes, dentist's drills and lathes, washing machines, adding machines, etc., and is also employed as a small field regulator, heating regulator and in numerous similar places where a small rheostat is necessary. The front of the Midget regulator consists of a handsome slate panel on which there is mounted the contacts, operating lever and



two terminal posts. The operating lever, which is of steel, is equipped with a handle and fitted with a brush held tightly against the contacts by means of a strong spring. The casing is of cast iron, dust and moisture proof and contains the resistance units. The resistance of the Midget regulators consists of a high grade special wire wound upon a slate core covered with a special cement and baked, making it absolutely moisture and dust proof. The resistance unit is mounted on the back of the regulator front so that the removal of the front carries the resistance with it from the casing allowing it to be easily replaced whenever necessary without the necessity of replacing any other part of the rheostat. This regulator is built to operate motors from $1/20$ to $1/6$ horse power.

A New Color Changing Device for Lamps on Electric Signs



The Reynolds Electric Flasher Manufacturing Co. have recently placed on the market a novel and practical invention in the shape of a lamp hood or shade, by which means color schemes and effects are produced in electric signs and displays. The cup or hood is made in variously colored glass, such as ruby, amber, green, blue, opal and frosted. The hood slips over the lamp bulb

easily and holds firmly in place by means of a non-corrosive, weather-proof spring device. Color schemes and effects almost without limit are possible with these colored lamp hoods. Changes can be made from time to time, as the cap can be removed from the lamp quite as easily as it is put on. The advantages of a lamp hood over artificially colored lamps are obvious, as the lamps are expensive and

the dipped or stained glass does not last, and estimating the cost of re-dipping, the lamp hood is found cheaper. Furthermore, laboratory, as well as practical tests have shown that the life of natural or artificially colored bulbs is reduced one-half on account of the colors radiating more heat than clear glass, and causing the filaments to burn out more quickly. The colored lamp hood allows the use of clear lamps, as provision is made for ventilation. Large electric signs invariably require colored effects to tone up the display and Reco lamp hoods are found very desirable for work of this kind, as well as for street and other decorations.

The "Beehive" Trio

To complete the so-called "Beehive" trio, a series of widely distributing reflectors, the National X-Ray Reflector Company, of Chicago, has produced a new type, as illustrated herewith. The original and well-known "Beehive" reflector, which has been on the market for a couple of years, was designed expressly for the illumination of the Patten Gymnasium of the Northwestern University.



The manufacturers have since found an extensive application for this reflector in large high rooms, in factories, shops, armories, gymnasiums, press rooms, etc. The large "Beehive" was designed for 100, 150 and 250 watt lamps. The third member of the "Beehive" trio, shown herewith, is a small reflector, No. 555, for 25 and 40 watt lamps. The peculiar designs of the "Beehives" make them very effective when shielding the tungsten lamps from view.

The Jefferson Glass Co.

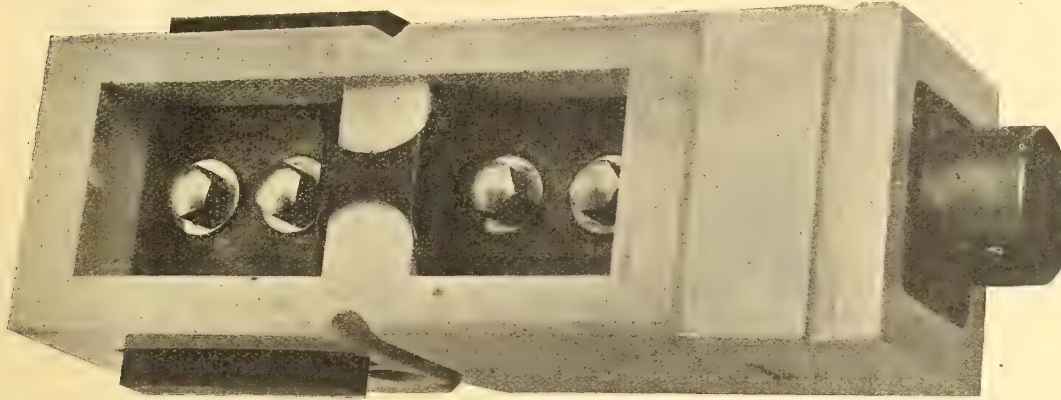
The electrical and gas trade of Canada are naturally interested in home productions and it will be a satisfaction to them to know that the Jefferson Glass Co., Limited, have opened a Toronto Factory at 388 Carlaw avenue where Canadian made glass will be designed and made especially for the Canadian market. The mammoth furnaces were fired on Tuesday, Nov. 5th, 1912, with every department thoroughly organized. Glass of artistic design and superior quality will be the chief products. Staple designs will also be furnished. The factory will produce various designs in the famous 'Luceo' and 'Moonstone' diffusing glass, moulded and blown in artistic lighting designs, some resembling sculptured effects. Glass for the new and efficient semi-indirect systems of lighting will be furnished in beautiful bowls of marble whiteness or subdued old ivory tints. Street lighting glassware will also receive special attention. Architects and contractors are cordially invited to co-operate with the Illuminating and Engineering Department of this company in the planning and installation of all their modern lighting.

Gordon River Power Co.

The Gordon River Power Company, Victoria, B.C., recently applied to the Provincial authorities for a license to take and use 1,200 cubic feet of water per sec. out of Gordon river. The water will be diverted at a point situated about 40 miles N.W. of Victoria and will be used for power purposes on the land described as "within a radius of 100 miles."

Subway Cut-out and Branch Block

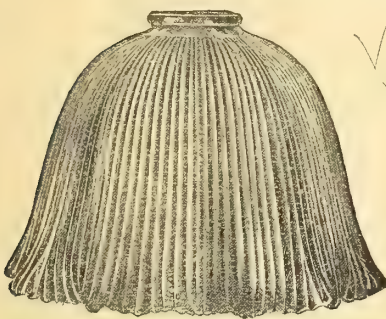
In low tension two and three-wire underground systems where it is necessary to take off several branch circuits without the necessity of splicing cables, wiping joints, etc., the Subway Cut-out and Branch Block has found special favor. The use of this block permits of any arrangement of distribution, in that it is designed on the single unit principle, making possible the building up of any number of either



three wire or two branch circuits when required. The construction of the cut-out affords protection against moisture. Also it is comparatively small, and requires very little space for mounting.

The cut-out illustrated herewith is worthy of special attention at the present time because of the increasing number of underground systems, of both high and low tension, being installed by the larger power companies throughout Canada. This block is one of the newest underground devices developed by the Metropolitan Engineering Company of Toronto. This company have recently found it necessary to enlarge their premises in order to meet the increasing demand for their meter testing devices and on Nov. 1st moved to more commodious quarters at 90 Sherbourne street, Toronto.

"Radio" Reflectors



Munderloh & Company, Limited, electrical supplies, Montreal, recently mailed to the electrical trade throughout Canada a small bulletin illustrating their "Radio" crystal reflectors, which will be found acceptable to the trade requiring prismatic shades. Electrical contractors have long been looking for an article in this line superior to the cheap imported shades, and yet at a price which will enable contractors to install a good system of store and public-building lighting at figures which will net them a larger profit than where they are called upon to install much higher priced shades without the equivalent in effective lighting. Messrs. Munderloh & Company, Limited, will be pleased to mail the bulletin on application to their Montreal office.

Best Proportions of Boiler and Economizer Surface

The counter-current or multi-stage principle in steam generation, towards the adoption of which there appears to be a tendency in recent practice, is discussed in a pamphlet entitled "The Best Proportions of Boiler and Economizer Surface," issued by the Green Fuel Economizer Company,

of Matteawan, N. Y. In this booklet a method is developed for determining the proper limits of boiler and economizer surface and it is shown that the most economical results are obtained from a boiler properly proportioned for transmitting the heat of evaporation, with an economizer for progressively warming the feed water. The practical result is a boiler of 4 to 6 square feet per boiler horse power, discharging gases at 600 to 700 deg. F. to an economizer in which they are cooled to 300 deg. F. or lower, depending upon whether or not mechanical draft is used. It is pointed out that the economizer transfers two or three times as much heat as could the same amount of additional boiler surface at the same point in the travel of the gases, because of the greater temperature head available between the hot gases and feed water as compared with that between gases and steam, the result being greater steam making efficiency at lower cost.

Radiant Equipment

The Radiant Electric Company, of Grimsby, Ont., are placing some very handsome and reliable electric household equipment on the market at the present time. These include electric coffee percolators, warming pads, radiators, electric irons, etc., etc. At this time of the year, for example, few articles of household equipment are more appreciated than a comfortable warming pad which is designed to take the place of the leaky cumbersome hot water bottle. The radiant warming pad is soft, light and flexible and the heating element is enclosed in an outer removable cover-



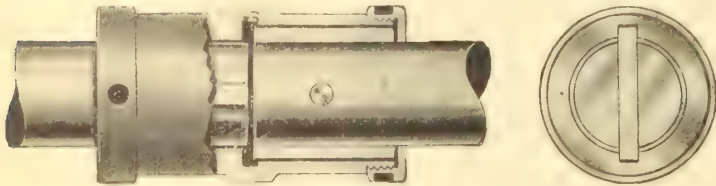
ing of eiderdown so that the pad may be kept in a sanitary condition. This company also makes a specialty of a three-lamp luminous radiator from which they guarantee a greater return of heat for energy consumed than is possible from any other make of radiator.

Another new production which is meeting with favor is a disc-stove set, shown in the accompanying figure. This combination consists of a six-inch improved disc-stove and cord, a nickel plated kettle, an aluminium frying pan and an aluminium double boiler.

Light was first switched on in Watrous, Sask., a town with a population of 781, on February 20th, 1912. The load at that time was only 37 services connected. The rate charged is 20c per kw.hour. Revenue has increased from \$257 a month in March to \$397 a month in August, and the superintendent believes this figure will soon reach \$500.

An Improved Steel Coupling for High or Low Speed Shafts

A new form of flexible coupling made entirely of crucible cast steel, and to dimensions especially suitable for this material, is being introduced by McEwen Bros., Wellsville, N.Y. This McEwen coupling, illustrated herewith, is said to have the smallest diameter and mass, and therefore the smallest inertia of any truly flexible coupling on the market. The keys extend clear through the shafts, are set at right angles and are arranged to permit a marked degree of misalignment, yet because of ample key bearing surface and the exceptionally good lubrication from packing of heavy oil or soft grease, there is no noise or tendency toward serious wear. The design is particularly good for withdrawals parallel to the shaft axis, and very small clearance is required



for removing any part. This type of coupling was first used and has been given its severest test upon McEwen Bros. pumps direct-connected to steam turbines running 24 hours per day for months at a time. The satisfaction it has given under these high speeds and other severe conditions as reversible motor drive for machine tools would seem to indicate a general usefulness for blower, rotary pump, motor, generator, turbine and line shaft connections, as well as other machinery of any speeds.

Union Electric & Contracting Co.

Mr. Frank Goodwyn, who has been for the past few years general sales manager of the Canadian Tungsten Lamp Company, Limited, and its kindred firm, the Ontario Lantern and Lamp Company, Limited, of Hamilton, has resigned his position and has formed a general partnership with Mr. Ambrose Moore, a well-known electrician, and is carrying on a general electrical contracting business, under the title of the Union Electric & Contracting Company, Limited, with offices at 84 King street east, Toronto. Although the company has been so recently formed, they have already got their hands full, with contracts of various kinds. They specialize in particular on intricate work and heavy installations. This move has necessitated Mr. Goodwyn's moving from Hamilton to Toronto, where, however, he has already many friends.

Canadian Union Electric Company

The Canadian Union Electric Company, head office Montreal, propose opening a Toronto office which will be in charge of Mr. Allan B. Wearing. Mr. W. H. Bitham will be manager of the Montreal office. This company carry large stocks of electrical equipment.

Trouble which arose over the question of wages of telephone line men and others resulted in minor strikes at different points in Saskatchewan.

Superintendent Peters has expressed the opinion that when Moose Jaw's new municipal steam turbo-generator plant is complete this city will have the most modern equipment in the prairie provinces. Our reference in the November issue to this new plant was by mistake credited to Regina, possibly on account of the two plants being somewhat similar in design. The Moose Jaw plant, however, will be all new as a result of the disastrous fire which almost completely destroyed the old generating equipment some months ago.

Surface Switch Without Protruding Button

The circular base type surface switch illustrated herein has been added to the surface switch line made by The Cutler-Hammer Mfg. Co. of Milwaukee. This new switch is made in two styles No. 7107 having a label holder and No. 7108 having a plain cap without label holder. The label holder is of value where a num-



ber of switches are located together, each switch label indicating the circuit or lights controlled. The depth of this switch is only $1\frac{3}{4}$ inches and the diameter of the cover or cap, which is of polished nickel, is $1\frac{7}{8}$ inches. The circular base is the same as other surface switches, but is hollowed out to make room for ends of circular loom or conduit. One of the particular features of this switch is that there is no protruding button which may be broken off, or by turning the wrong way, be removed and lost. The ingenious mechanism of the Cutler-Hammer switch makes it possible to eliminate this rotating button and substitute the straight pushbar which is a part of the mechanism and cannot be removed and, since it does not protrude, cannot be accidentally knocked off as easily as the button. The pushbar is indicating, as it has a light button at one end and a black button at the other. The rating of the 7107 and 7108 switch is 5 amp., 125 volts and 3 amp. 250 volts (National Electrical Code Standard).

Siemens Supply Equipment

The Siemens Company of Canada have recently received an order from the Canada Sugar Refining Company for a 250 kw. motor-generator set, consisting of a 3-phase slip-ring type, 60 cycle, 2200 volt induction motor with short-circuiting brush-lifting device, direct coupled to and mounted on the same bedplate with a 250 kw. direct current, three wire, 220/110 volt, compound wound generator. The speed of the set is 880 r.p.m. The generator will be provided with a Siemens two-piece commutator and also commutation poles. For starting up the set, liquid starter with hand crank and worm gear will be supplied. A year ago the Siemens Company supplied the same firm with a 150 kw. direct current three-wire generator driven by a high speed vertical Belliss engine, which has given great satisfaction.

P. & S. Receptacles

A new style Pass & Seymour receptacle. No. 62358, is illustrated herewith. This receptacle carries the wires one inch from the surface wired over and is used largely for outdoor decorative work, as well as in some forms of sign construction. The terminals have been rearranged to permit the use of a sealing compound which is poured over the contacts after connection is made. The lugs for supporting receptacle have been so arranged that a stove bolt with a square head may be used when required.



The Queen-Gray Company of Philadelphia, J. G. Gray, President, announce that they have purchased the going business of Queen & Company Inc., and will continue the handling of engineering, electrical and scientific instruments, at 618 Chestnut street and 611 Sansom street.

New Companies

The Canadian Light and Power Co. Ltd., has been incorporated with head office at Vancouver. The usual wide powers were asked.

The New Hazelton Bridge and Power Co. Ltd., has been incorporated with head office at Prince Rupert, B.C.

The Westminster Power Co. Ltd., has been incorporated with head office at Vancouver. Power is asked to carry on all kinds of electrical operations.

The Pine River Light and Power Company, Limited, has been incorporated with a capital of \$200,000 to carry on the above business in all its branches, with head office at Orangeville. The provisional directors are F. H. Kilbourn, barrister; H. B. Smith, furniture manufacturer, and Jas. Garvie, accountant, all of Owen Sound, Ont.

Should Be "Behind the Bars"

Editor Electrical News,
220 King St. W., Toronto

Dear Sir:—

Please be advised that a gang of crooks have been successfully fleecing central stations in various parts of this country by the use of the following method. A foreigner, dressed in the height of fashion, with a signet ring, gold headed cane, etc., drives up in a carriage and informs the manager that he is representing his father who is a large iron manufacturer in France or Germany, as the case may be, and that they have discovered a process of manufacturing tool steel by electricity and contemplate the establishment of a plant in this country to use electric power and would like to figure with you on rates. After interesting the central station in this way he suggests that you order a few sample bars of their tool steel at 55 f.o.b. your town. After you have placed your order, 18 ft. bars of ordinary tool steel, or such as the case may be, will

be shipped from the nearest jobber, sight draft on B/L which has been negotiated and is now held by a holder for value. Tool steel in bars of 18 ft. at 55 cts. a pound runs to a considerable sum of money and offers a large profit to the promoter of this scheme.

Yours very truly,

VALDOSTA LIGHTING COMPANY (Georgia)

Per W. G. Eager.

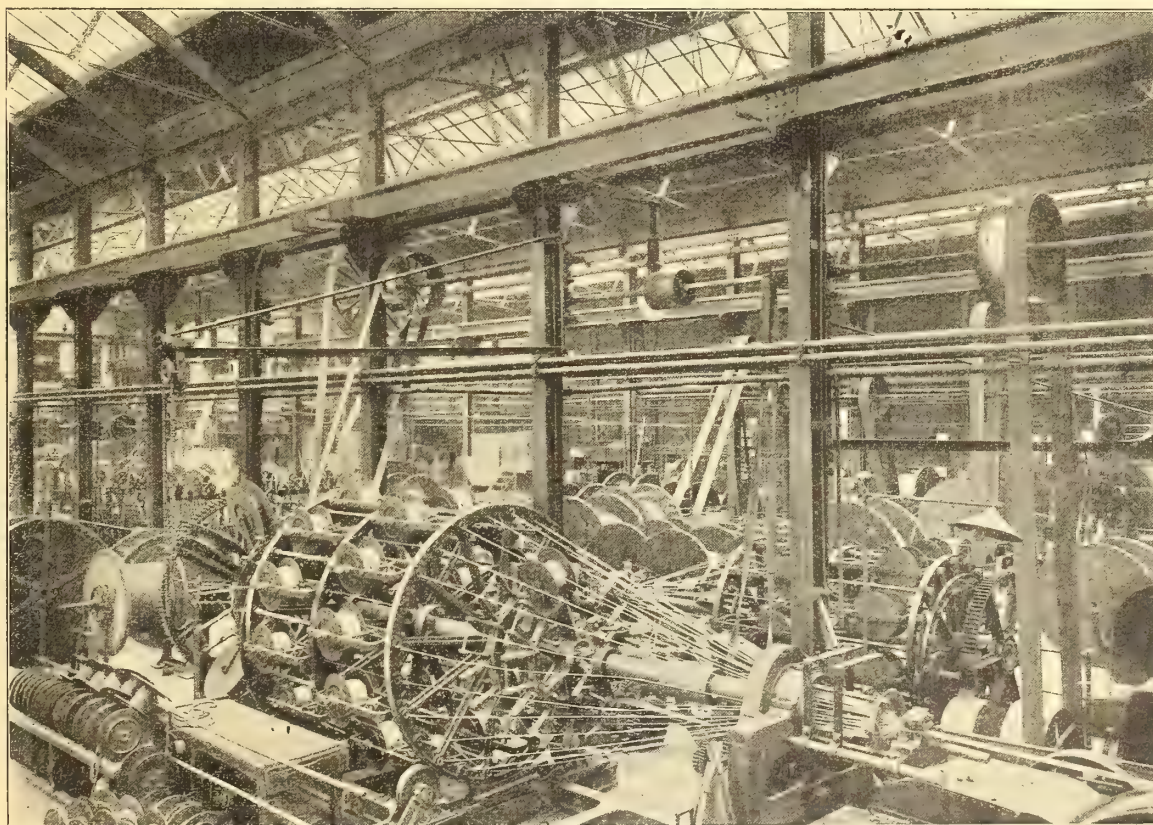
We publish the above correspondence in the hope that we may be of assistance in treating these crooks to some of their own medicine by placing them "behind the bars."
[Ed.].

The Canadian Porcelain Co.

The Canadian Porcelain Co., Limited, has been incorporated with a capital stock of \$300,000 to manufacture vitrified white porcelain for electrical and other purposes. They have purchased a 20 acre site in Hamilton, Ontario, and will put up a plant, the first unit to cost \$150,000. The buildings will be of steel and brick and will be ready for operation next spring. George Alden, Chas. Palmer of Rochester and Fred. D. Palmer of Galt, Ont., are the principal directors.

W. T. Glover & Co.

The cut shown herewith illustrates a corner of one of the work shops of a British insulated wire and cable maker, namely: W. T. Glover & Co., Ltd., of Trafford Park, Manchester. The machine shown in the foreground is a wire-armouring machine. During the last ten years this company have secured some of the largest cable contracts ever let, five of these amounting to upwards of a million sterling. These contracts included cables for low, high and extra-high pressures.



Wire-Armouring Machine in workshops of W. T. Glover & Co.

Current News and Notes

Alberni, B.C.

A by-law authorizing the expenditure of \$30,000 for electric light purposes passed.

Brechin

A by-law was carried on November 22nd on the question of obtaining supply and power from the Hydro-electric Commission.

Berlin, Ont.

The rapid increase in the demand for power will necessitate the addition of 1,000 h.p. in transformer capacity. The present capacity is 1200 kw. made up of six 200 kw. units. The Canadian Consolidated Rubber Co. claim that they will require from 400 to 600 h.p. in the spring, with gradual increases later.

Brantford, Ont.

This city will secure power for \$19.50 per h.p. on condition that 1200 h.p. is taken from the commission.

Beaverton, Ont.

A by-law carried favoring an agreement with the Hydro-electric Commission.

Colborne, Ont.

The by-law to raise \$4,840 on a telephone system recently received the endorsement of the burgesses.

Campbellford, Ont.

This town has commenced a publicity campaign especially with reference to cheap power, and is issuing an illustrated booklet setting forth the advantages to manufacturers in this direction.

Chesterville, Ont.

A by-law recently passed to install a Hydro-electric power system.

Calgary, Alta.

An office and warehouse building to cost \$135,000 will be erected here by the Canadian General Electric Company, head office, Toronto.

Street railway extensions and improvements to cost half a million dollars has been decided on by the city commissioners. Track extensions totalling 10½ miles are calculated to cost \$109,000. The balance is made up as follows: completion of double track construction, \$68,000; track specials, \$33,350; rolling stock, \$226,000; car barn equipment, \$23,000.

Danville, Que.

It is reported that H. Max Rickey & Co. have purchased the electric light plant from Gibson Brothers. Mr. C. E. Thompson will be retained as superintendent.

Esquimalt, B.C.

Negotiations are under way between the council and the B. C. E. R. Co. looking to the installation of equipment sufficient to operate 300 80-kw. tungsten lamps for street lighting. Mr. C. S.

Manchester, of Vancouver, is consulting engineer for the town.

Guelph, Ont.

It is said the city will require a new electric fire alarm system in the near future.

Georgetown, Ont.

A by-law was passed on November 9th, authorizing the closing of a contract with the Hydro-electric Power Commission to secure a supply of power.

Huntsville, Ont.

The Ravenscliffe Telephone Company has practically completed the construction of its line from Ravenscliffe to Huntsville. Connection will be made with the Bell Telephone Company at the latter point. Twenty-five subscribers are already on the line with the prospects of increased numbers. The annual rental to the subscriber is \$12.50, of which \$2.50 goes to the Bell Company in payment of their interchanges with the Huntsville line.

Halifax, N.S.

A resolution has been passed by the city council favoring the acquiring of the Halifax Tramway System and its operation as a municipal utility.

Humboldt, Sask.

A by-law was carried on November 4th to expend \$30,000 on an electric light plant.

Kingston, Ont.

At the recent meeting of the Utilities Committee a communication was received from J. M. Campbell, of the Kingston Milling Company, offering the city 500 horse power continuous at three-quarters of a cent per kilowatt hour. The power would be generated at Kingston Mills, about five miles from this city. A contract will likely be closed.

At a recent meeting of the Board of Works with the Utilities Committee to discuss the proposal of the Street Railway Company in connection with the paving of Princess street, a sub-committee, composed of Ald. Elliott, chairman of the Board of Works; Ald. Rigney, chairman of the Utilities Committee, the superintendent of the light plant and the city engineer was appointed for the purpose of negotiating for the purchase of the street railway company's property.

London, Ont.

Sir Wm. Mackenzie and his associates are reported to have taken over the charter of the London & Northwestern Railway. This road was designed to connect London with Sarnia through Lobo, Arkona, Warwick and Plymton with numerous side lines.

At the suggestion of Sir Geo. Gibbons, a committee has been appointed to enquire intimately into the conditions surrounding the proposed electrification of the London and Port Stanley railway.

A large number of London's most influential citizens compose the committee.

Now the population of the city has passed the 50,000 mark there is a growing agitation for Sunday street cars.

The London Street Railway Company have announced an increase in wages affecting about 150 of its employees. The increase was unsolicited. The new scale is as follows: Spare men from 16c to 18c per hour; first year, 18c to 20c; second year, 19c to 21c; third year, 19c to 22c; and fourth year and over 22c to 23c.

The water commissioners have felt for some time that they have been paying too large a sum for illuminating the streets. The amount is \$30,000 and the decision is in part the result of an offer by a private company to supply the same service for a much smaller sum. After some hesitation the Hydro-electric Power Commission has expressed its willingness to discuss the matter with the water commissioners.

Montreal, Que.

A contract is said to have been closed for 50,000 h.p. between the Aluminum Company of America and the Cedar Rapids Power Company. The balance of power will likely be required by the Montreal Light, Heat and Power Co.

Moose Jaw, Sask.

The new 500 kw. engine and generator to be used by the Moose Jaw Street Railway Co. is on its way from England. The engine is of the Diesel crude oil type. The generator equipment is being supplied by the Canadian General Electric Co. The boilers by the Babcock & Wilcox Co. The power house measures 154 ft. 6 in. long by 89 ft. wide by 32 ft. high. The old system was two-phase, but the system being installed is three-phase.

North Bay, Ont.

On November 18th the town of North Bay voted favorably on the question of obtaining a supply of power from the Hydro-electric Power Commission.

Ottawa, Ont.

Two immense power schemes, both of which contemplate the damming of the St. Lawrence River at points between Montreal and Prescott, and both of which are backed by powerful interests, are now before the Government for consideration. The schemes in question are that of the Long Sault Development Co., backed by the Aluminum Company of America, and that of the Eastern Canada Power Company, backed by Sir Max Aitken and D. Lorne McGibbon, together with other prominent capitalists.

Parry Sound, Ont.

The Hydro-electric Commission has sent in a report on power development on the Moon River. With proper storage facilities the plan is believed to be feasible.

Port Dalhousie, Ont.

The Hydro-electric power was recently turned into the new municipal distri-

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SIEMENS BROS. DYNAMO WORKS

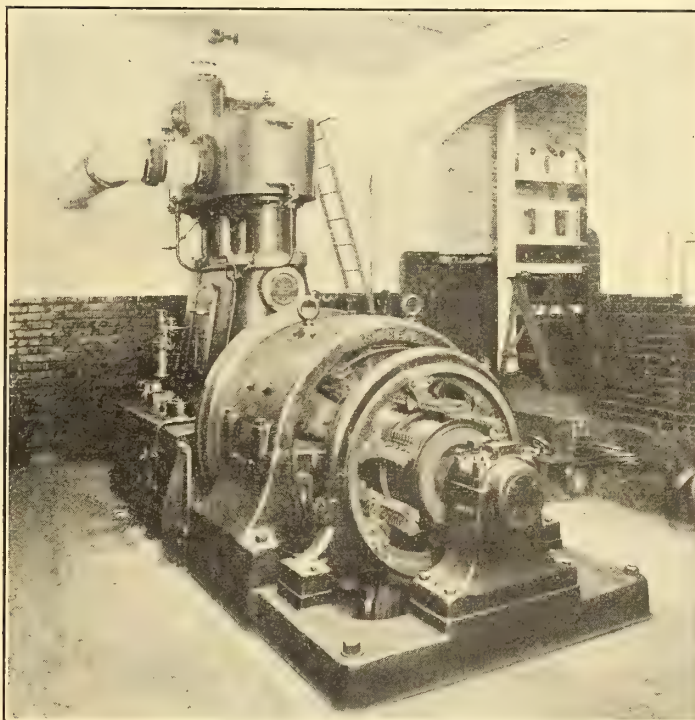
SIEMENS BROS. & CO.

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SIEMENS & HALSKE



Siemens 150 K.W. 110/125 Volt Direct Current Generator running at the Canada Sugar Refinery Co., Montreal

After the machine had been running some months we received an order from the same Company for a 250 K.W. motor generator.

We have supplied or on order a large number of D.C. generators for Canada, amongst which we would mention the following:

1-800 K. W. Canadian Collieries
 1-700 " Canadian Collieries
 1-800 " Dominion Coal Co.
 1-750 " City of Edmonton
 2-500 " City of Port Arthur
 2-500 " Nova Scotia Steel & Coal Co.
 2-500 " City of Winnipeg

2-400 K. W. City of Regina
 1-400 " City of Lethbridge
 1-250 " Canada Sugar Refinery Co.
 1-220 " Dominion Coal Co.
 1-200 " City of Lethbridge
 1-150 " Canada Sugar Refinery Co.
 1-150 " Winnipeg General Hospital

Siemens Company of Canada, Limited

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STANDARD BANK BUILDING
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 WINNIPEG

buting system of Port Dalhousie after the village had been in darkness for several weeks during the interval that elapsed since the Maple Leaf Rubber Company ceased to supply the corporation with fifteen arc lights. Under the new system eighty tungsten lamps are used.

Prince Albert, Sask.

The Mayor of Prince Albert is in negotiation with a manufacturing industry claiming to require in the neighborhood of 10,000 h.p. of electric energy and to employ 2,000 men. It is the desire of the men at the head of the industry to take over the La Colle Falls power development.

Regina, Sask.

The estimates of city electrician E. W. Bull for next year's requirements for street lighting and other materials in connection with the power plant and distribution system will total up to \$115,000. This does not include \$80,000 which it is proposed to expend on an ornamental street lighting system along the main streets which expense will be cared for on the local improvement plan.

Rapid City, Man.

A by-law carried by 74 to 5 to provide \$12,000 for the purchase of an electric light plant. The British Canadian Engineering Supply Company have the contract. It is believed that between 100 and 150 services can be connected up at once and that the plant will be self-sustaining from the start.

St. John, N.B.

The St. John Railway Company has ordered ten pay-as-you-enter cars for its service, and six of them have arrived. The company has awarded the contract for a new chimney 75 feet high and will also put in huge boilers and a generator to increase its capacity to provide power for manufacturers.

Sudbury, Ont.

It is said that a move is being made to build the electric line from Sudbury to Copper Cliff, Creighton, Murray Mine, Coniston, Carson Mine and other places in the neighborhood, a charter for which was granted to the Sudbury, Copper Cliff and Suburban Electric Railway Company at the last session of Parliament.

St. Catharines, Ont.

The city council declined to consider the request of a number of residents to obtain an estimate of the cost of power from the Ontario Hydro-electric Commission. The council feels that the present contract with the Lincoln Electric Light Company is too satisfactory to justify any change.

Saskatoon, Sask.

The city has been advertising for a superintendent for their new railway system. In this connection also it was suggested that the order for single truck cars recently placed with the St. Louis Car Company be cancelled and that double truck cars be purchased instead.

Toronto, Ont.

The subway under the C. P. R. and C. N. R. railway tracks at Yonge street, North Toronto, will be deepened so as

to leave a headway of 18 feet. The idea is that this would permit of double deck street cars or motor busses. To get a satisfactory grade, the level of Yonge street will have to be lowered for some distance south of this point.

Residents of Ward 7 are asking for the extension of the civic car lines west to High Park, failing which an offer of the Suburban Railway Co. to construct a single track line may be accepted.

At the recent convention here of the Canadian Independent Telephone Association, the following motions were passed:—

1. "That this association petition the Government of Ontario to so amend the Telephone Act that where an Ontario Independent Telephone Company cannot arrange terms with a municipality for the use of the streets or roads on the municipality that the matter may be referred to the Ontario Railway and Municipal Board who shall have jurisdiction to hear both parties and grant permission on such terms as it considers fair.

2. "That legislation be procured to put the ordering of interchange of business under the jurisdiction of the Dominion Railway Board and the Ontario Railway Board in joint session.

3. "That in view of the fact that a special committee on the revision of the Provincial statutes, regarding assessment meets at an early date, this convention should appoint a committee of three members to consider amending the Assessment Act in regard to telephone lines, and meet the Provincial committee and present the views of this convention." A committee was appointed.

At a recent meeting here of the Municipal Electric Association, called to discuss the question of a system of electric railways throughout the areas served by the Hydro-electric Power Commission of Ontario, and to be under the control of this Commission, the following resolution was adopted:—

"Resolved—That in the opinion of this meeting, representing over thirty Ontario municipalities, it is desirable that a system of electric railways, including street railways to be owned by the municipalities, be established and built; and, further, that the Hydro-electric Power Commission be requested to look into the advisability and practicability of constructing such a system and to furnish a report thereon to this association.

"In order that the request to the Hydro-electric Power Commission be made definite, it is further suggested that the initial report should refer only to roads following the Hydro transmission lines of the Commission at present existing and contemplated in the Niagara power zone extending throughout Western Ontario and the Midland district. It is desired that the report shall cover cost of construction, of operation, and probable revenue in each case."

It is understood the civic car lines will be operated by a commission. This body may either act independently or be a subsection of the Toronto Hydro-electric Commission.

The franchise has expired on the stub line on Queen street east of the Scarboro

Beach grounds. The T. S. R. Co. was not anxious to continue to operate them but offered to do so on payment from the city of 20 cents per car mile plus all receipts. The Ontario Railway Board has approved this arrangement for a space of 90 days.

Representatives from Uxbridge, Newbury, Aurora, King, Richmond Hill, Markham, Unionville, Bradford and the surrounding districts will meet the provincial hydro-electric commission in Toronto the first week in December to discuss the power situation with a view to having the hydro service extended to these places.

Power contracts have been sent out for signature from the offices of the Ontario Hydro-electric Commission to Windsor, Niagara Falls, Elmira and Chesterville. Recently the Hon. Adam Beck signed contracts with Brantford, Paris, Port Dalhousie, Brockville and Prescott.

The Toronto Electric Light Company has given notice to the city that it will proceed to lay underground conduits on Spadina avenue from King street east to the first lane south and west on this line from Spadina to the end of the land.

Vancouver, B.C.

The B. C. E. R. Co. has been making provision for the further extension of the Jordan River system. A large band of men is employed on the new dam located at the end of the present flume line, which when completed, will have cost in the neighborhood of \$350,000. This dam will be, it is stated, 125 feet above the bed of the ravine and its length about 800 feet. When completed, the storage capacity of the system at that point will be increased by about 60,000,000 cubic feet, and with the present Bear Creek reservoir, a total reservoir capacity of about 90,000,000 cubic feet will be available. This increased supply of water will fully provide for the continuous operation of the new unit just added and subsequent additions which will certainly be made in the next few years.

Windsor, Ont.

The expenditure of \$20,000 in new equipment for the local lighting plant is being discussed.

Welland, Ont.

Following the refusal on the part of the Water and Light Committee to submit the value of the privately owned plant to arbitration and on the refusal of the private company to accept less than \$90,000 for the plant, the town council has authorized the committee to proceed with the construction of a private distributing system which will use power to be obtained from the Hydro-electric Power Commission of Ontario.

Wadena

A by-law has been passed authorizing the expenditure of \$20,000 in the installation of an electric light plant. The British and American Engineering Company, of Winnipeg, has the contract, which is to be completed January 5th, 1913.

Woodville, Ont.

On November 21st a by-law was carried by the ratepayers to decide the question of the purchase of a supply of hydro-electric power.

TEN POINTS

1. The scale is uniform throughout the entire range of deflection.

2. The readings can be made with practically the same precision on violently fluctuating loads as on steady loads.

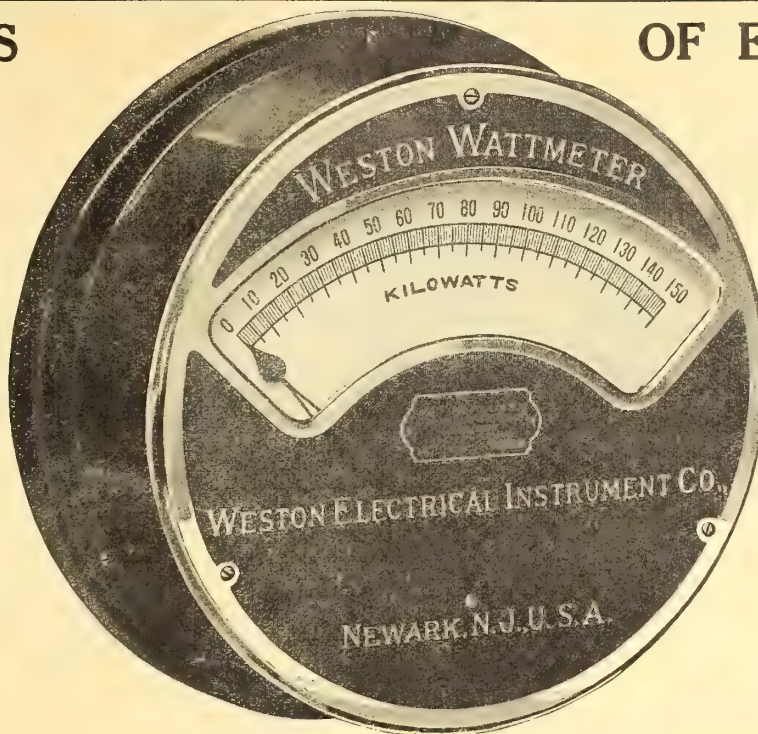
3. The indications are equally accurate on direct-current circuits or on alternating-current circuits of any frequency, power-factor or wave form within commercial limits. Therefore, these watt-meters can be calibrated with direct-current and used on alternating-current circuits without change of calibration.

4. The scale is flat and is therefore easily read.

5. The pointer is entirely free from vibration produced by mechanical resonance.

6. The power consumption is extremely small.

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8. They are far more reliable and durable than any commercial wattmeter heretofore built.

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10. The zero position of the pointer can be adjusted from the outside without removing the instrument from the board.

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Two Northey feed pumps, cylinder 5 in. and
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All the above water and steam connections in
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Price, \$3,000

The above plant will be sold at this extraor-
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A rare bargain for anyone who can use this
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THE OTTAWA ELECTRIC COMPANY,
35 Sparks Street,
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Moonlight Schedule for December, 1912

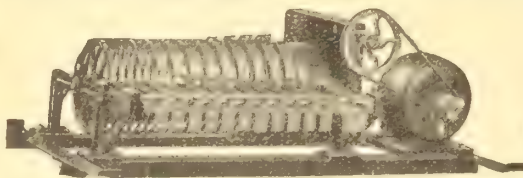
Courtesy of the National Carbon Company, Cleveland,
Ohio.

Date.	Light.	Date.	Extinguish.	No. of Hours
Dec. 1	5 00	Dec. 2	1 50	8 50
2	5 00	3	3 00	10 00
3	5 00	4	4 10	11 10
4	5 00	5	5 20	12 20
5	5 00	6	6 30	13 30
6	5 00	7	6 30	13 30
7	5 00	8	6 30	13 30
8	5 00	9	6 30	13 30
9	5 00	10	6 30	13 30
10	5 00	11	6 30	13 30
11	5 00	12	6 30	13 30
12	5 00	13	6 30	13 30
13	5 00	14	6 30	13 30
14	5 00	15	6 30	13 30
15	5 00	16	6 30	13 30
16	10 40	17	6 30	7 50
17	11 40	18	6 40	7 00
19	0 50	19	6 40	5 50
20	1 50	20	6 40	4 50
21	3 00	21	6 40	3 40
22	4 20	22	6 40	2 20
23	No Light	23	No Light	
24	No Light	24	No Light	
25	5 10	25	7 50	2 40
26	5 10	26	9 10	4 00
27	5 10	27	10 30	5 20
28	5 10	28	11 40	6 30
29	5 10	30	0 50	7 40
30	5 10	31	2 00	8 50
31	5 10	Jan. 1	3 10	10 00

Total.....267 20



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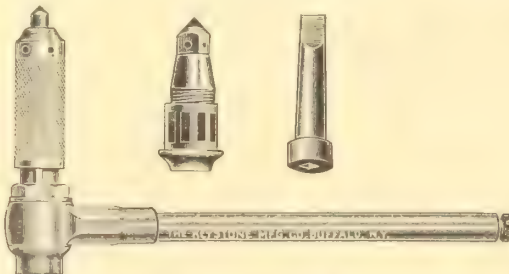
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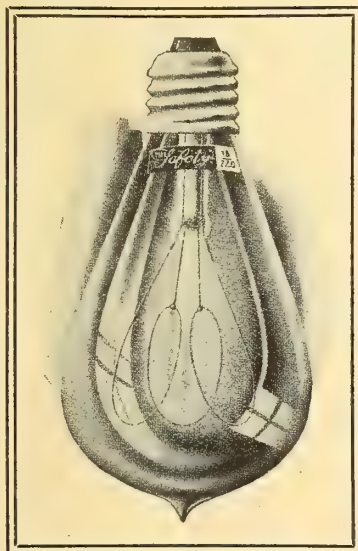
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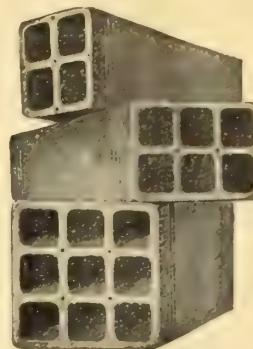
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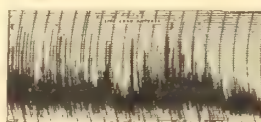
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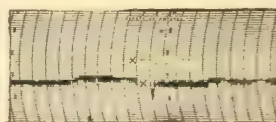
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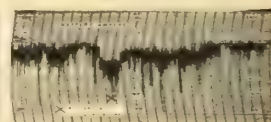
Battery Load, being difference
between line and generator.



Line Load amperes.



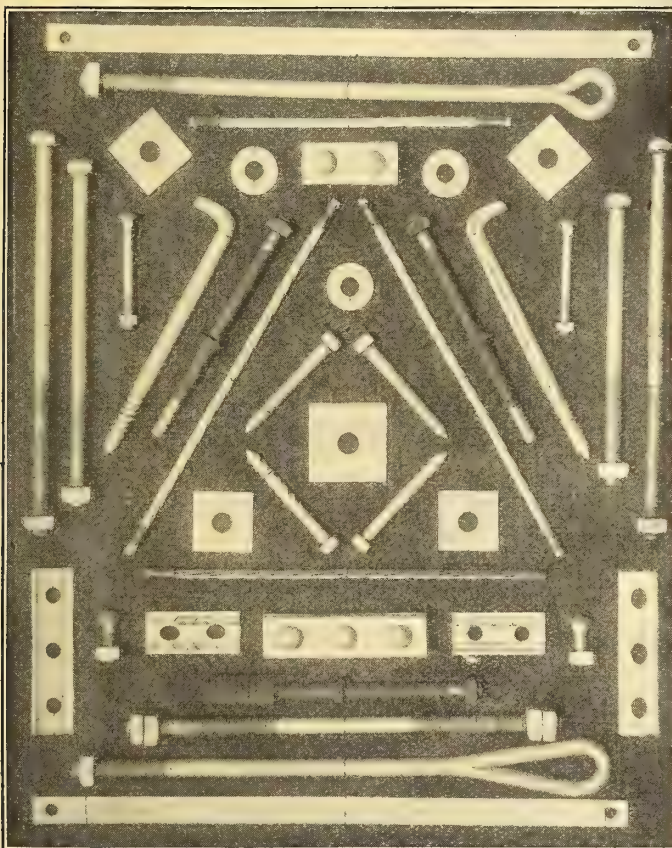
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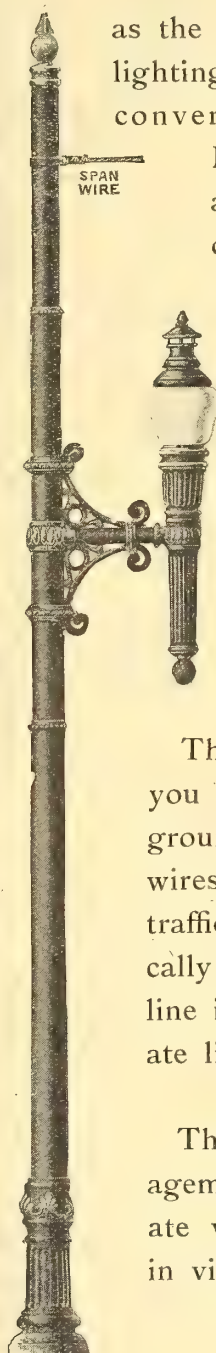
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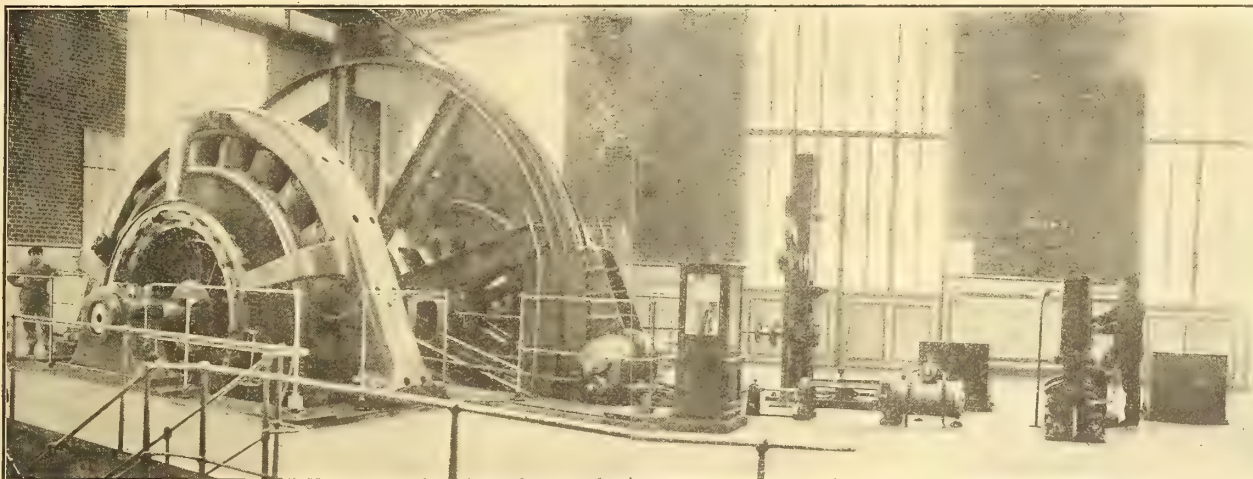
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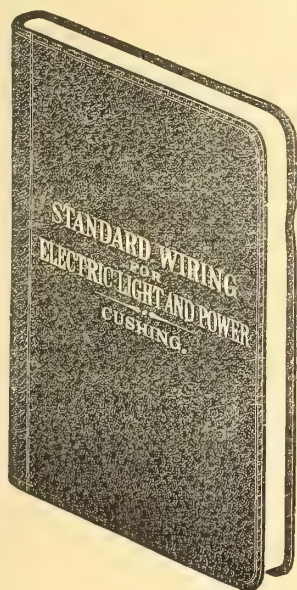
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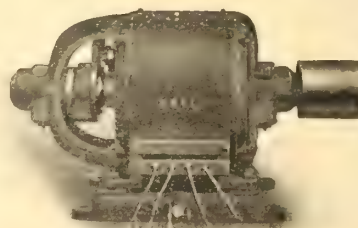
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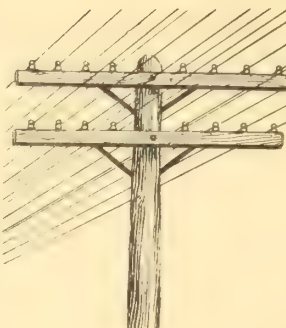
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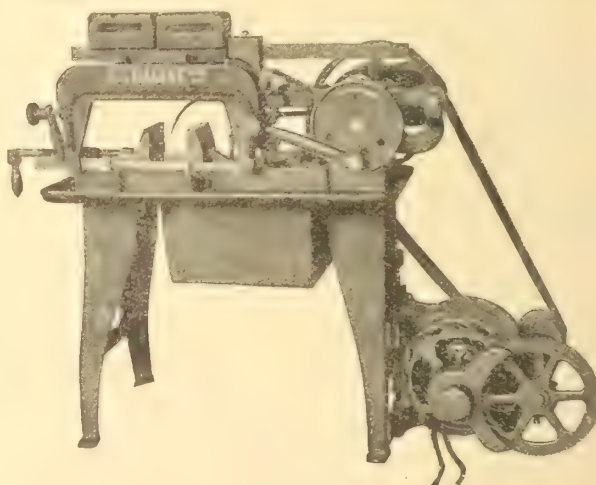
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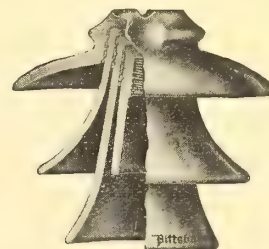
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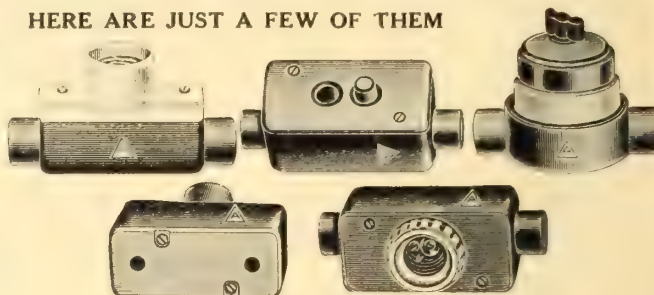
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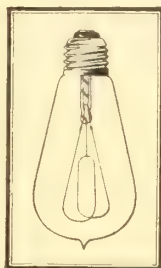
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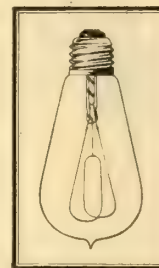
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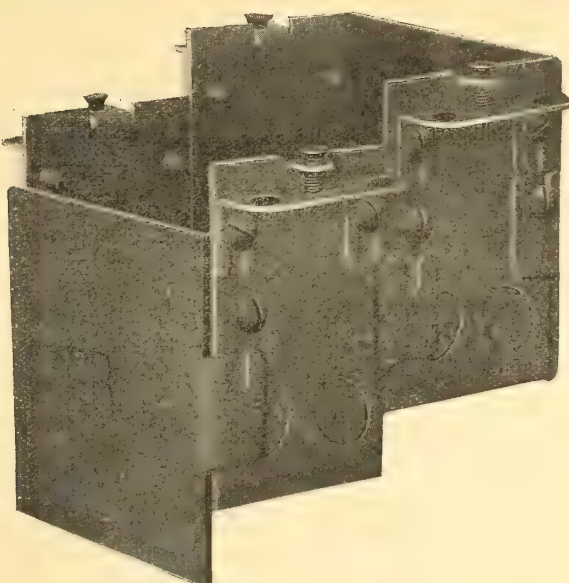
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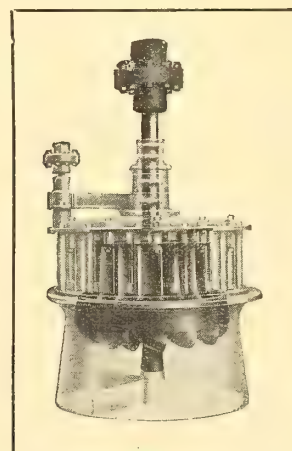
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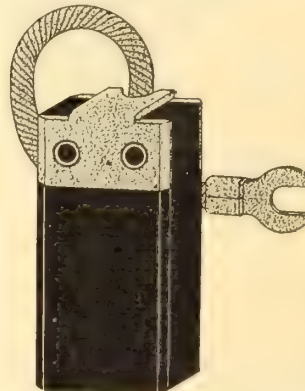
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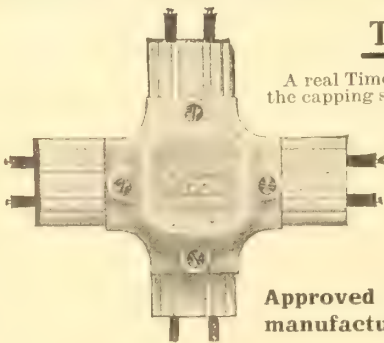
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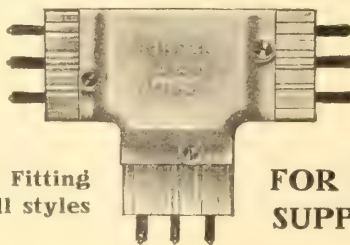
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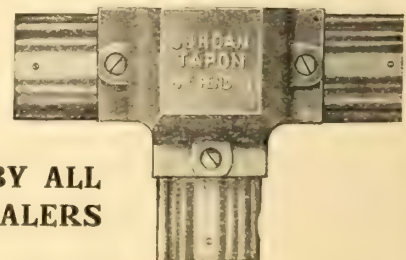
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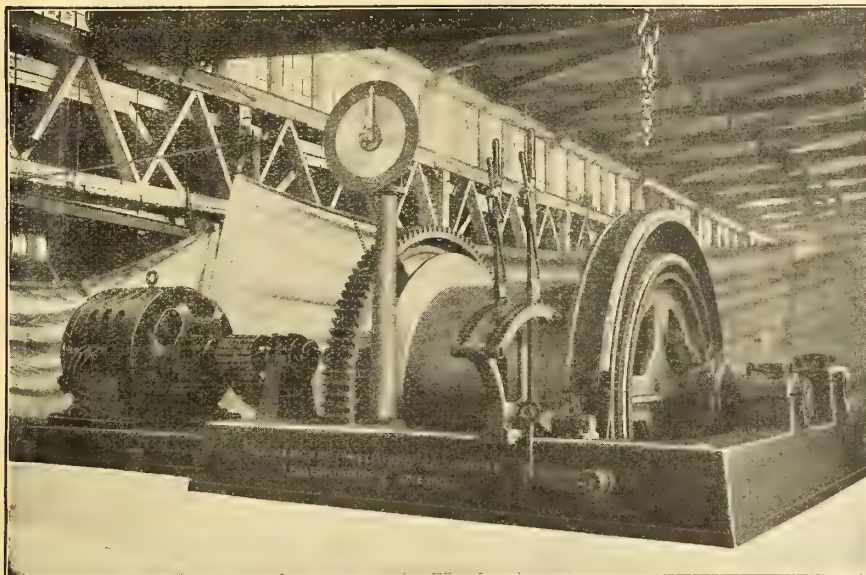


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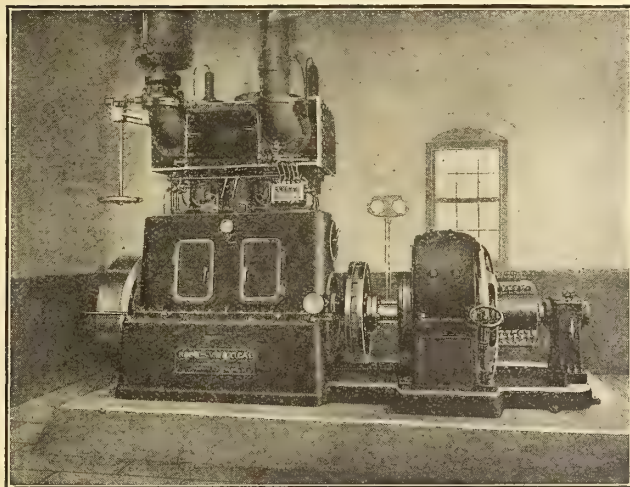
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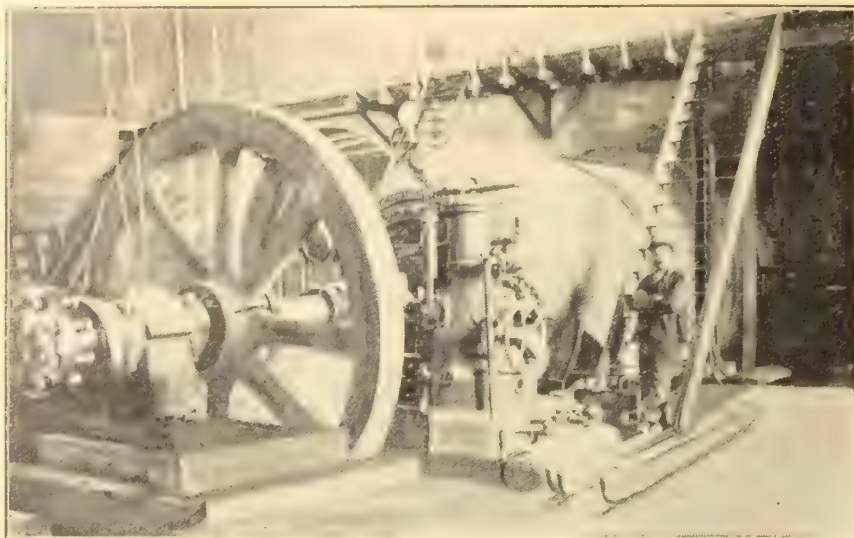
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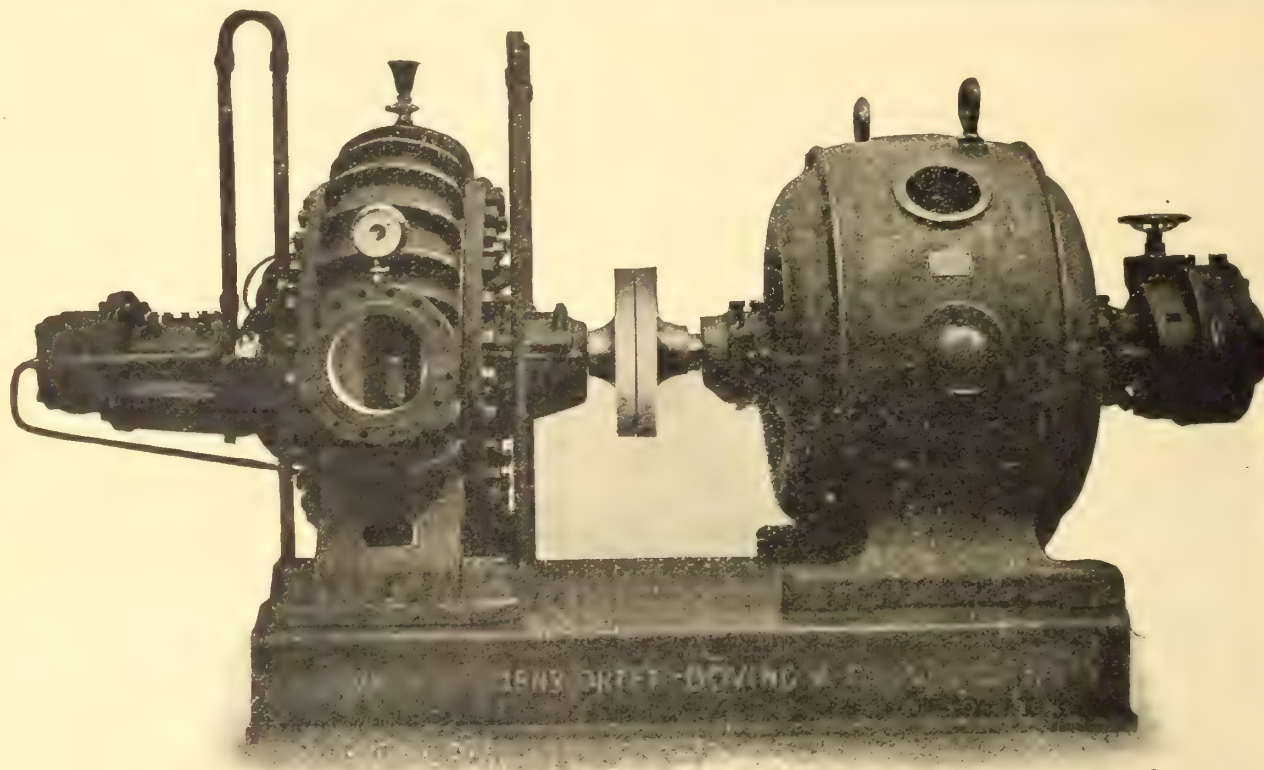
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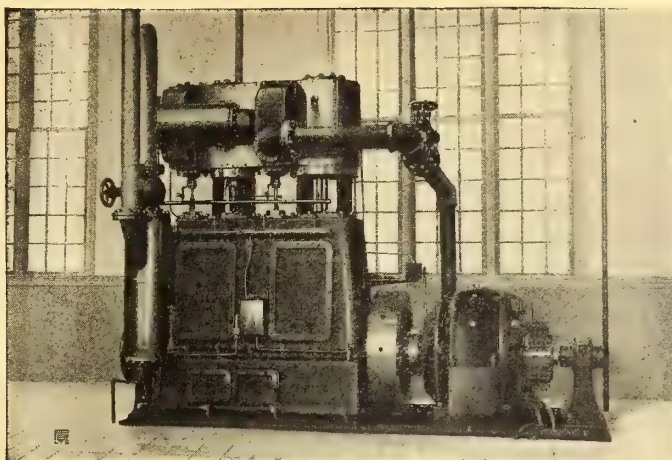
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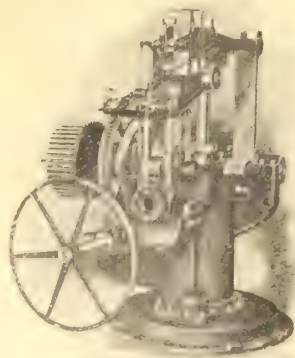
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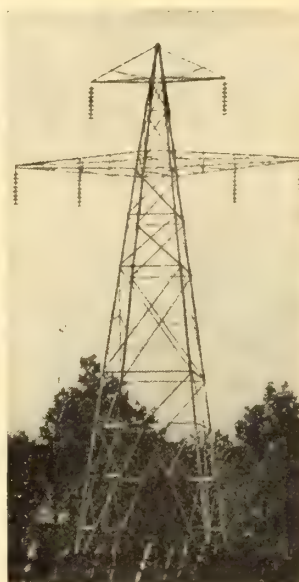
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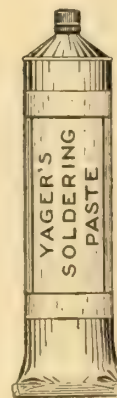
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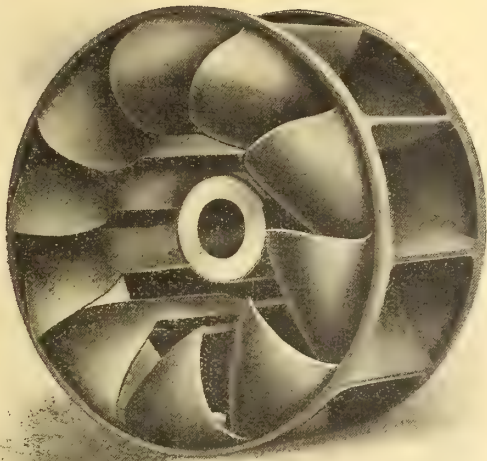
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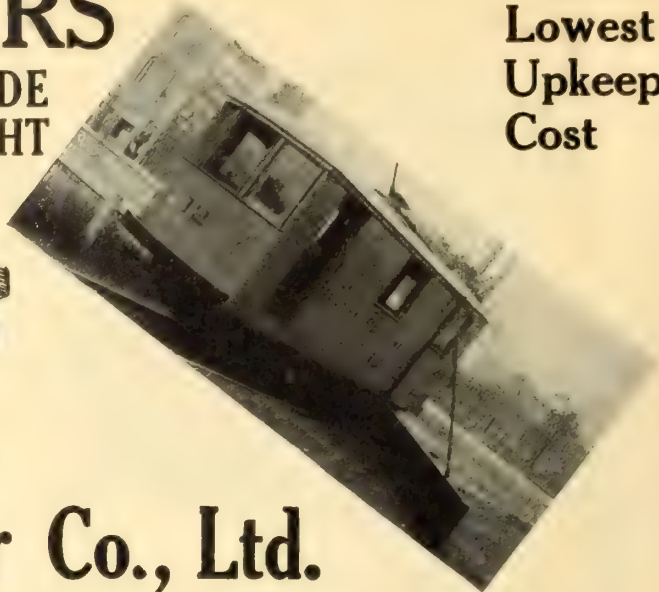
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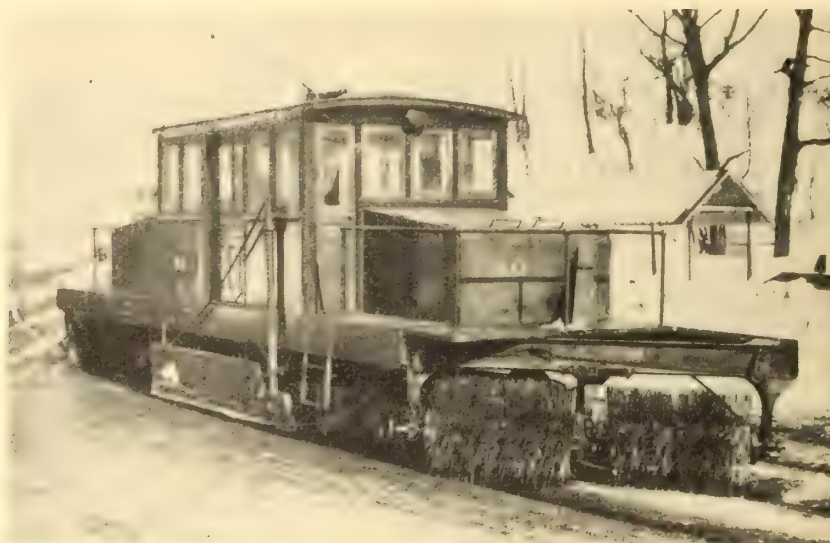
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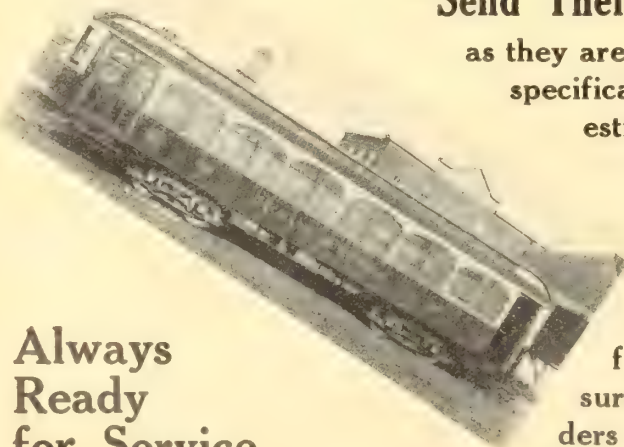
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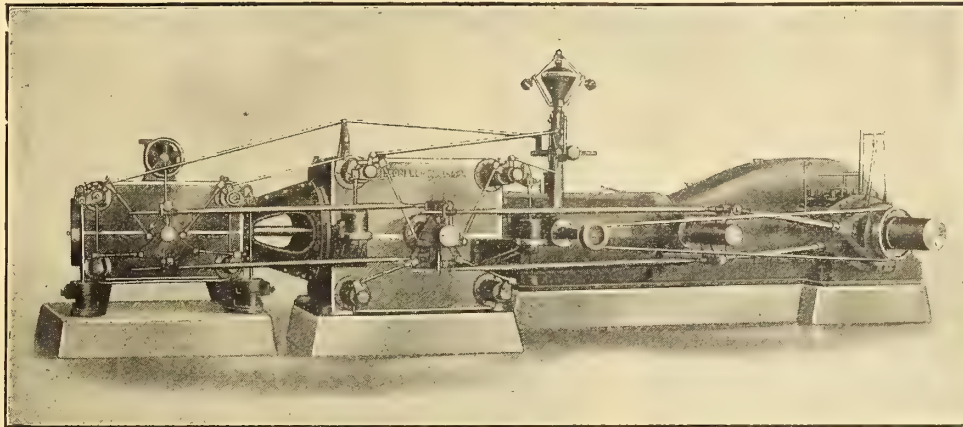
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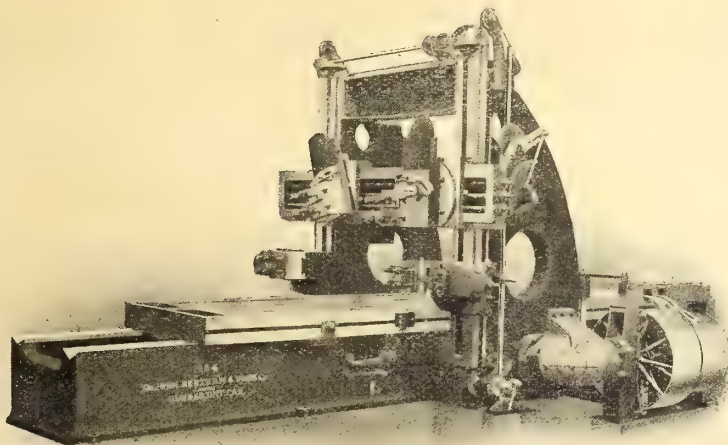
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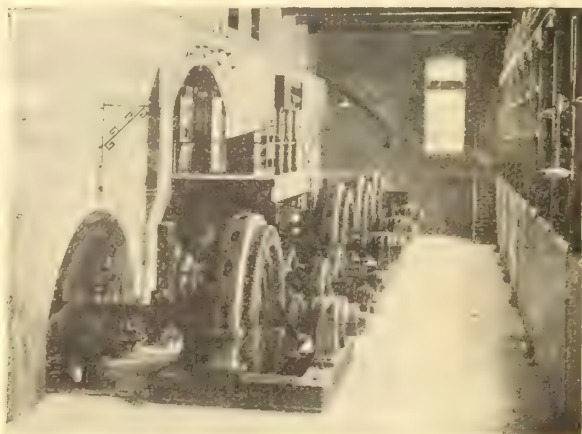
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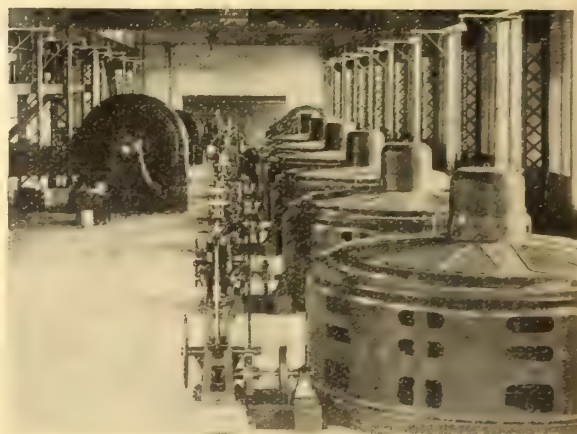
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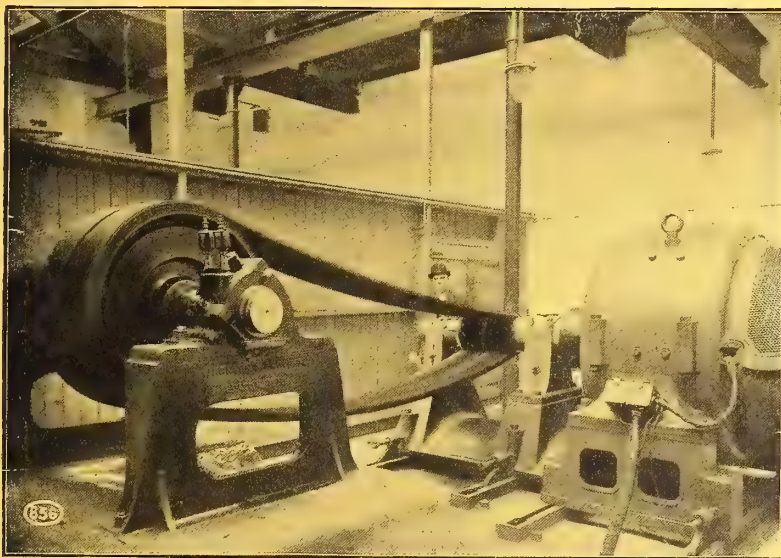
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